

CORONATION ISSUE

June 1953

Agriculture

*The Journal of the
Ministry of Agriculture*



The English Rose

VOL. LX

No. 3

PUBLISHED

9^d

MONTHLY

HER MAJESTY'S STATIONERY OFFICE



Sussex contrast

SUSSEX is a county of contrasts. It is the most thickly wooded of all the English counties, yet it is renowned for its open, windswept, treeless Downs. Close beside the bracken and gorse of forest and heath will be found the brilliant green of well-managed Wealden farms.

On one of these, four years of accurate costings have led to much better methods of management and far higher financial returns. Permanent pasture has been replaced by temporary leys which, when ploughed, are followed by better crops of

cereals and kale. Milk production has been increased by 11,500 gallons, while purchased concentrates are now fed at the rate of only $\frac{3}{4}$ lb. per gallon. Grass is almost the only food for the larger dairy herd in summer, while in winter it is fed with home-grown grain, kale, silage and hay.

What has been the main factor in producing these changes?—*more nitrogen per acre*. The plough has gone round the farm, and every acre of grassland now receives 4 cwt. of 'Nitro-Chalk' annually.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON S.W.1

FSC/53/6



Please mention AGRICULTURE when corresponding with Advertisers

The science of plant protection



You can rely on 'Agroxone' to clear weedy pasture . . . fast!

Fewer weeds mean more grazing on the same area and weedy pasture can be improved—quickly and thoroughly—by a combination of 'Agroxone' and good management. 'Agroxone' is the *safe* hormone selective weedkiller based on MCPA. 'Agroxone' increases the stock carrying capacity of your grassland. And remember, clean pasture means weed-free hay and

silage—saves labour wasted by cutting, carting and drying weeds. 'Agroxone' is easily applied as a liquid by low or high volume sprayers or, as a powder, by fertilizer distributor. Ask your local 'Plant Protection' Agent for the free 'Agroxone' manual or—write for it to, Room 42, Plant Protection Ltd, 61 Curzon Street, London, W.1.

'AGROXONE' KILLS BUTTERCUP, HORSETAIL, RAGWORT, COMMON RUSH, THISTLES



FOOD
DRIVE

Plant Protection Ltd



Please mention AGRICULTURE when corresponding with Advertisers

PIG PROFITS ARE BIG PROFITS

**with this proved Infra-Red
Heater**

WITH the Philips Infra-Red Farrowing Unit breeders find they can rear 25% more weaners from the number born—and save 4-6 weeks in reaching bacon size. Here are six reasons why this compact Philips unit is the accepted equipment for successful pig rearing.

- 1 Deaths due to overlying eliminated.
- 2 Farrowing in winter made profitable.
- 3 Piglets kept warm—in fresh air.
- 4 They grow faster, need less food to maintain body heat.
- 5 Inexpensive to buy, economical to run.

Price complete: £37.0. No Purchase Tax

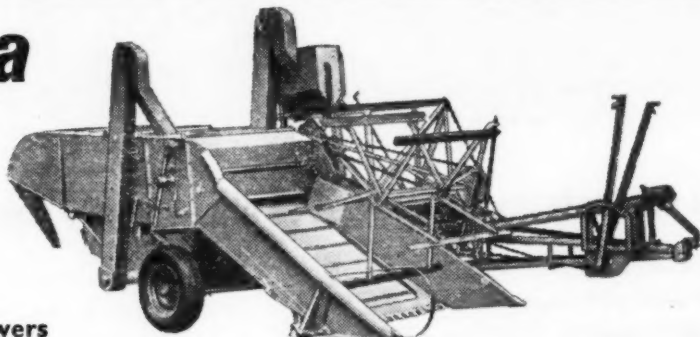


PHILIPS

Further details from: **PHILIPS ELECTRICAL LTD.**
Century House, Shaftesbury Ave., London, W.C.2
LAMPS & LIGHTING EQUIPMENT • RADIO & TELEVISION RECEIVERS

(1D245D)

Why a 4ft. cut?



These are the answers

- Because under ALL conditions 4 ft. is within the capacity of the P.T.O. drive of the tractors in everyday use on the farm.
- Speed of combining is dependent on the machine's capacity to handle bulk of straw, *not* width of cut only. The 4 ft. Combine travels FASTER.
- Minimum initial outlay, low operating and maintenance costs—your own tractor to drive and haul it—gives you the most economical combine ever offered in this country.
- The 4 ft. Combine has been proved in operation over 4 years and is now in use by nearly 4,000 convinced users in many parts of the world.

Ransomes reputation is the guarantee of this combine. Supplies are being made available this year from Sweden, in advance of Ransomes production.

**RELY ON RANSOMES
—ALL THE YEAR ROUND**

**ASK YOUR LOCAL RANSOMES
AGENT FOR FULL DETAILS AND
LITERATURE - NOW!**

Ransomes 4ft. Combine

RANSOMES SIMS & JEFFERIES LTD., IPSWICH, EDINBURGH, WATFORD Manufactures include : Ploughs . Harrows . Cultivators
Toolbars . Horticultural Tractors . Subsoilers . Potato Harvesters . Harvesters . Threshers . Balers . Sprayers . Crop Driers

Please mention AGRICULTURE when corresponding with Advertisers



World-Wide **D**emand !

Get in quickly...

Its low cost—nearly £100 less than any comparable diesel... its low consumption of low-cost fuel (a saving during its life of over £800 against Vaporising Oil)... its longer engine life... its ability to save money—for both farmer and nation... star the Fordson Major DIESEL as the

greatest tractor Value, and create world-wide demand for it. Men Who Know Value have placed their orders for the Fordson Major DIESEL. So ask your Fordson Dealer for a free demonstration on your farm. And remember—delay costs you money day after day.

IMPORTANT NEWS. NEW FINANCE FACILITIES FOR FORDSON MAJOR DIESEL OFFER VERY ATTRACTIVE H.P. TERMS. YOUR FORDSON DEALER HAS FULL DETAILS.

D FORDSON MAJOR DIESEL



LEADS IN VALUE

FORD MOTOR COMPANY LIMITED · DAGENHAM · ESSEX

Please mention AGRICULTURE when corresponding with Advertisers

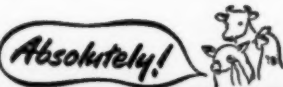
WHERE'S THE BENEFIT
OF RESEARCH.....?

IT'S IN
THE BAG!



Vitamealo contains the known requirements of good feeding for perfect growth, health and production—for cattle, pigs and poultry.

Join in the 60%
Plus Food Drive



INSIST ON RATIONS CONTAINING

VITAMEALO
CONCENTRATES

Ask your local merchant for delivered in prices

A.F.P. Ltd., 23, Upper Mall, Hammersmith, London, W.8.



ENGLAND'S BEST CHICKS

THE "STANDARD"
SET BY



TURNEY BROS.
QUINTON GREEN, NORTHAMPTON
TELEPHONE: ROADE 220



USE

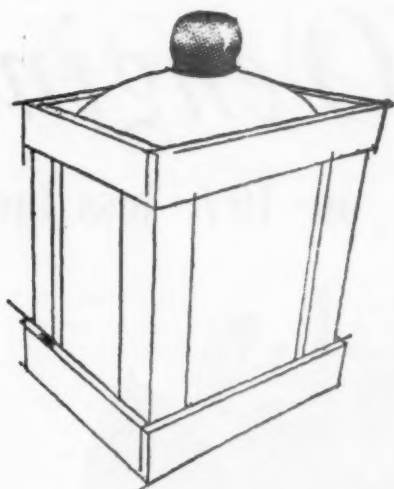
'ALBERT'

Basic Slag
for
ALL CROPS

and take advantage of
the Fertiliser Subsidy

★ Literature and advice free from J. Harold Thompson, B.Sc. (Agric.)
Chief Agricultural Adviser BRITISH BASIC SLAG LTD., Wellington
House, Buckingham Gate, S.W.1, ABBey 4606-7-8 or in Scotland
from J. S. Symington, B.Sc., (Agric.), Waterloo Chambers,
19 Waterloo Street, Glasgow, C.2. Tel. CENTral 2441.

Please mention AGRICULTURE when corresponding with Advertisers



If you have a "clean milk" problem, the Deosan Laboratory and technical service are at your disposal.

not only what but also how

Right products and right procedure are of equal importance in fighting bacterial infections of milk... That's why the DEOSAN ROUTINE continually wins new adherents... Products designed for the job, and a method designed for the products... Constant research and practical farm experiment keep both up-to-date.

DEOSAN

top name in dairy farm hygiene

Deosan Ltd : 345 Gray's Inn Road, London, W.C.1. (ONE OF THE MILTON GROUP OF COMPANIES).
Obtainable from Corn and Agricultural Merchants and Boots the Chemists

"Jolly Good Salt On The Farm!"



Stoved Vacuum Salt for Cattle Food, Mineral Mixtures and all Dairy Purposes. Also Agricultural Salt (all qualities) for the land. Write to address below for Free Leaflet "Agricultural Salt as a Fertiliser".



Jolly Good Salt

PALMER MANN & CO. LTD.,
Dept. "A" Sifta Salt Works, Sandbach, Cheshire

Please mention AGRICULTURE when corresponding with Advertisers

Announcing the new *VO engine*
giving 10% more power on 10% less fuel
with longer engine life



NUFFIELD

UNIVERSAL
POWERS ALL FARM WORK - REDUCES COSTS

QUICK FACTS

Re-designed combustion chamber minimises detonation.
Cylinder head carries 14 mm. long-reach detachable sparking plugs.

Improved cooling of engine and exhaust valve region.

Thermostat controls temperature and ensures rapid warm-up.

Ignition by coil and distributor.

Fully floating pick-up for the submerged oil-pump and a full-flow filter are embodied in the lubrication system.

PLUS all the traditional features which have made the Nuffield Universal the most advanced tractor on the market to-day.

PRICE : Basic model M4 (V.O. Engine) £465 (ex works)



Write for fully illustrated literature and arrange for a demonstration on your land with your implements. Your Nuffield Supplier will gladly arrange this.

MORRIS MOTORS LTD. (AGRICULTURAL DIVISION), COWLEY, OXFORD
Overseas Business: Nuffield Exports Ltd., Oxford and 41, Piccadilly, London, W.1.



Please mention AGRICULTURE when corresponding with Advertisers

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Editorial Offices : 3 Whitehall Place, S.W.1

(Phone : TRAfalgar 7711)

VOL. LX

No. 3

JUNE 1953

¶ Provided that the source is acknowledged in each instance, such articles and notes as are published in this Journal without any specific reservation regarding copyright may be reproduced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.

¶ Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.

¶ All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Cowlshaw and Lawrence (Advertising) Ltd., 28 New Bridge Street, London, E.C.4. Telephone: City 5118 and 1542.

Contents

Page

Royal Farming at Windsor. <i>Eric Rea and S. L. Huthnance</i>	101
The Royal Gardens at Windsor. <i>G. Soane and R. C. Round</i>	105
Farm and Estate under Elizabeth the First. <i>Nigel Harvey</i> ..	108
The Crown Lands. <i>J. A. Hillman</i>	112
Research for Plenty : No. 8. New Foods for a Crowded World. <i>N. W. Pirie</i>	116
The English Rose. <i>A. H. Hoare</i>	121
Seaweed as a Stockfood. <i>W. A. P. Black</i>	126
Research at Long Ashton. <i>Professor T. Wallace</i>	131
Colorado Beetle in England, 1952. <i>I. Thomas and I. R. Harrison</i>	138
Farming Affairs	142
Book Reviews	146

Cover Photograph

The English Rose

Copyright : Reginald A. Malby/Keystone





for progress and profit

In grass . . .
SHELL D
WEED KILLER

Are you taking full advantage of the higher yields and bigger profits that come from using Shell Weed Killers? Today you can weed grassland at low cost with Shell D. ★ The control of Thistles, Buttercup, Rushes and other perennial weeds works out at 14/3 per acre for material. The removal of these weeds, by spraying, leaves the way clear for the development of nutritious herbage under efficient grassland management. Your local Shell Chemicals Distributor has been appointed not merely to sell you supplies. Ask his advice on all weed-killing problems. The Shell range is one of the widest on the market and wherever Shell Weed Killers clean the land, farmers are winning bigger profits from higher-yielding crops.



Shell Chemicals lead in weed killing

★ The best way to prove it is to try Shell D (2, 4-D).
In liquid form for high or low-volume spraying.

Shell Chemicals Limited, Norman House, 105-109 Strand, London, W.C.2.
(DISTRIBUTORS)

Please mention AGRICULTURE when corresponding with Advertisers

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LX

No. 3

JUNE 1953

ROYAL FARMING AT WINDSOR

ERIC REA, M.Sc., N.D.A., N.D.D.

Provincial Director, N.A.A.S., South-Eastern Province
and

S. L. HUTHNANCE, B.Sc., N.D.D.

County Agricultural Officer, Berkshire

High level production from the Royal Farms at Windsor is concentrated on three main lines—milk, cereal grains and poultry.

THE Royal Home Farms at Windsor extend to about 600 acres and lie in a block east and south-east of the Castle, with the Prince Consort's Home Farm lying in the northern half, Shaw Farm in the centre, and Clayhall Farm to the south. The Windsor to Staines road runs through the block, cutting off Clayhall Farm to the south. These farms come under the day-to-day management of Mr. A. V. Pelly, the Land Steward, Surrey born and Wye College trained, who took charge in October 1951, following a long line of Scottish predecessors. The adviser on farming policy is Mr. Frank Sykes of Wiltshire.

The whole of the area is relatively flat and the soil varies from a dark alluvial light working soil adjoining the River Thames in the north-east to heavy loam overlying London Clay, which in places on Clayhall Farm is within six to eight inches of the surface.

The analyses of a fairly comprehensive series of soil samples recently taken from the farms showed that there is a variable lime requirement, with probably 25 per cent of the farming in need of fairly heavy lime dressings at regular intervals. The phosphate content is also variable but could be described as fair, but the potash is rather low, particularly on the more gravelly sections.

As at present organized, the farm has three main lines of production—namely, about 200 acres of cereal grain (barley and wheat) for sale, milk from two dairy herds (Jerseys and Ayrshires), and a poultry unit providing both eggs and table birds.

Cropping The Royal Farms are typical of many other farms in the country in the stages through which they have passed since the pre-war era. An article on these farms which appeared in this JOURNAL in July 1944, noted that before the war there were only 90 acres of arable on the farms and that the remainder was in grass or parkland. By 1944 about 340 acres were cropped and the plough was still moving round the farm.

The position now is that, by the ploughing up of another 150 acres of permanent grass during the past two years, the area of unploughed permanent grass has been reduced to less than 100 acres, and of this approximately

ROYAL FARMING AT WINDSOR

50 acres form a part of the golf-course. The stage has now been reached when long-term rotations are being planned to keep the land at this high level of cropping, with leys moving round to build up fertility for cereal crops.

The 200 acres of barley and wheat being grown for sale are about equally divided between the two crops. The only varieties of wheat in use are Hybrid 46 for autumn sowing and Atle in spring. They are sown with a combine drill. The autumn corn receives 2 cwt. per acre No. 1 type fertilizer, or 2 cwt. potassic supers, at the time of sowing, and a further top dressing of up to 2 cwt. per acre of a nitrogenous or complete fertilizer in the spring. The standard fertilizer for spring wheat is 3 cwt per acre of No. 1.

Two varieties of spring barley are also being tried, the old-established Plumage Archer, and the new variety Carlsberg. These are also combine drilled, and given 4 cwt. per acre potassic supers or a No. 7 type fertilizer which contains phosphate and potash but no nitrogen. There are, of course, a few variations from these standard practices.

In addition to the wheat and barley for sale, about 50 acres of winter oats (normally S.172) are grown for consumption on the farm. The fertilizer dressing used for this crop is similar to that given to autumn-sown wheat and the results are equally good, last year's crop averaging 21 sacks per acre.

There is an appreciable acreage of leys to be ploughed up each year for the cereal crops, and the present policy is to make use of these leys as late in the season as possible before ploughing. Thus grassland to be sown to autumn corn is not usually ploughed until after the cereal harvest, and those fields coming up for spring corn are not usually ploughed until the New Year. The aim, both with autumn and spring sowing, is to be as early as weather conditions will allow. But it is doubtful if the whole of the cereal sowing has been completed so early for many years as it has been this year, when the last field of barley was drilled on March 18. Last year drilling was not finished until April 28.

No roots other than potatoes are now being grown, but a big acreage of kale is put down every year, one or more areas being within easy reach of the Prince Consort's Home Farm buildings and another block close to Shaw Farm. These are grown for feeding off *in situ* by the two dairy herds, using an electric fence.

An unusual practice here is the sowing of thousandhead kale to the exclusion of marrowstem. Last year the earliest sowing of kale was in the third week of May and sowing was completed in early June. The land is done well for this crop, farmyard manure is ploughed in and 4-5 cwt. No. 1 type fertilizer given in the seedbed. In addition, the crop receives a top dressing of about 2 cwt. per acre of nitrogen. This year it is proposed to drill every fourth row with Hungry Gap kale, which will result in six rows of thousandhead alternating with two rows of Hungry Gap. The purpose of this is to facilitate the erection of the electric fence.

The 5 acres of land to be planted to potatoes, which are grown for use in the Royal Household, are treated similarly, except that about double the quantity of No. 1 type fertilizer is given. Certified Majestic Scotch seed is purchased annually.

The leys and permanent grassland are dressed each spring with 2-3 cwt. per acre of No. 1 type fertilizer, and occasionally fields are given subsequent dressings of nitrogen during the summer as required. Any farmyard manure not required for the kale and potato ground is spread over some of the grassland during the winter months.

ROYAL FARMING AT WINDSOR

The electric fence is used for strip grazing. This helps to reduce the grass acreage required for the two dairy herds and their followers and increases the acreage available for hay and silage. Grass silage is produced from leys, and something approaching 200 tons was made in 1952 in two clamps above ground, the leys having received 4 cwt. per acre of No. 1 type fertilizer.

Jersey Herd The Jersey herd has been a familiar sight on the Royal Farms for many years. More recently they have been dehorned. The removal of the horns from the Jersey breed is not so common as with some other breeds, but it is undoubtedly an asset in the management of this herd which now lies in covered yards at the Prince Consort's Home Farm during the winter. Milking takes place in the century-old but excellent cowshed, brought right up to date by two mobile twin milking machines, complete with churns. The total number of Jerseys in the herd is approximately 70, including about 35 cows in milk. It is proposed to increase the latter to about 45.

The Jerseys calve throughout the year and are not so rigidly winter milk producing as the Ayrshires. The calves are weaned in the usual way on the fourth day and are given whole milk diluted with 25 per cent water for the first three weeks. Gruel is introduced after about ten days. The calves are completely on gruel by the end of three weeks and are kept on this until they are about three months' old. In addition, they receive a small amount of skimmed milk, of which there is always a small quantity available, since a little butter is made at this farm to provide the Royal Household.

By the time they are weaned from gruel and skimmed milk, the calves are eating hay and a mixture of oats and flaked maize, plus a small quantity of calf nuts.

The young Jersey cattle are kept going on a reasonable plane of nutrition, and calves are not normally turned out in their first summer unless they are born before the New Year. In the normal way they are bulled to calve down at two years' old. From about twelve months to calving stage any young cattle being housed will be receiving hay, wet brewers' grains and straw *ad lib*.

The feeding of the dairy herd during the winter is based on kale and hay up to the end of the year, approximate quantities allowed being 50 lb. per day of kale and 7 lb. per day of hay. This, with a basic allowance of 10 lb. wet brewers' grains per day, is expected to provide for maintenance and the first 1½–2 gallons. Cows giving above this quantity receive a balanced mixture of purchased cake and home-grown oats.

In the New Year kale is replaced by 40 lb. of grass silage. The wet brewers' grains and concentrates are fed in the cowshed and the hay and silage in the covered yards. As previously mentioned, the kale is fed off *in situ* by means of the electric fence.

Ayrshire Herd The Ayrshire herd is a recent introduction and is located at Shaw Farm, where it makes use of buildings previously devoted to the Aberdeen-Angus, Hereford and Shorthorn beef herds. These premises have been converted to provide yarding accommodation for the milking herd, now numbering just over 40, for a four-point in-churn milking parlour and for excellent milk cooling and washing accommodation. The Ayrshire herd numbers about 80 and, like the Jerseys, has been dehorned by the electric iron.

ROYAL FARMING AT WINDSOR

The Ayrshires were introduced in the autumn of 1951 with a bunch of down-calving heifers. The average yield for the 30 heifers which completed their lactation year in 1951-52, was 8,239 lb. with a butterfat percentage of 3.85.

Having started so recently with a bunch of autumn calvers, this herd is of course a winter milk producing unit and the young followers in each group are all much the same age. The oldest group of offspring were being bulled in March and April of this year at an average age of about 18 months.

The feeding and management practice with this herd does not vary appreciably from that adopted for the Jerseys, but there are of course some variations ; for example, the newly-born calf is weaned from its dam after the first suckle, although for a few days afterwards it is given its mother's milk.

All the calves, being born in the autumn, go out to grass in the following summer ; they are also allowed to run out during their second winter, but are given access to a shed for shelter. During this outwintering they receive about 10-12 lb. hay daily, and in the late winter or early spring this is supplemented with silage.

The winter feeding of the Ayrshire milking herd differs only from that of the Jerseys in the quantities of bulk food fed. It is found that the Ayrshires will eat rather more silage than the Jerseys—about $\frac{1}{2}$ cwt. per day, as against 40 lb. All the cattle are, of course, attested.

Poultry Shaw Farm is also the site of the poultry enterprise. Three covered cattle courts have been inexpensively converted to new yards and carry between them about 1,000 Light Sussex \times Rhode Island Red layers. These birds are bought as day-old chicks in four batches of 300, each starting in the first week in January and continuing at intervals of three weeks. On arrival, the birds are placed in electric brooders and kept there for 2½ weeks. They are then moved out on to grass to units, which are provided with heat until the birds are about 7 weeks' old. The pullets remain outside on grass until they are 4½ months' old, when they are brought into the yards.

The litter in the hen-yards is entirely of straw, and fresh straw is added fortnightly. The yards are cleaned out annually. Grain balancer pellets and meal are always before the birds, and approximately one-third of their ration is home-grown grain.

When the electric brooders and fold units are not in use for rearing pullets for the laying flock, they are used for raising table birds ; about 1,000 were fattened last year. These have to be provided throughout the year and it is not possible, therefore, to standardize the age at which the table birds are killed. But "drawing" generally starts when they are 14 weeks' old.

Plans to enlarge the production of these table birds to something like 4,000 per year are at present being considered.

Machinery The machinery is typical of modern farms of this size, and is certainly not in excess of normal complement. The tractor strength is made up of four medium-powered wheeled tractors, three of which are run on vapourizing oil and the fourth on diesel oil. The barn machinery and the milking and dairy plants are driven by electricity.

Corn harvesting is done with one bagger-type combine, which is used for the winter oats as well as for the barley and wheat. A trailer elevator is

ROYAL FARMING AT WINDSOR

used for loading the grain sacks in the field, and this same machine is used for loading hay and straw bales.

Any drying of grain that may be necessary is carried out by a simple platform type drier heated by an oil-burning furnace, as developed by the National Institute of Agricultural Engineering. Silage-making is done by buck-rakes, of which there are three ; but the third is brought into use only when there are long-distance hauls. There is one dung spreader, and dung-loading is done by a hydraulic loader attached to a standard heavy tractor. Hay and straw are baled with a rotary pick-up baler, which is also used occasionally as a stationary baler.

Future Plans It is apparent that reorganization of the Royal Farms at Windsor is still in progress. Other proposals include starting a herd of Large Whites, the nucleus of which already exists in four pedigree gilts and sows and a Large White boar. At the moment consideration is being given to the best type of building and how existing buildings can be adapted to meet the desired increase in this section of the farm.

It is also intended to reintroduce a sheep flock eventually ; and the size of the dairy herds is to be increased.

The fulfilment of this ambitious programme means high level production from the grassland as well as from the arable, and there is plenty of evidence that this is taking place. The Royal Farms are, in fact, contributing in full measure to the drive for greater output from British farms.

THE ROYAL GARDENS AT WINDSOR

G. SOANE and R. C. ROUND, N.D.H.

National Agricultural Advisory Service, Berkshire

The 30 acres comprising the gardens at Windsor Castle are intensively cropped with fruit, flowers and vegetables to serve the Royal establishments and the commercial market.

THE Royal Gardens are situated a mile south of Windsor Castle, within the vicinity of the Home Park, near Frogmore House and the Long Walk, and altogether comprise about 30 acres. They were developed along their present lines by the Prince Consort in 1844, when the walled gardens were planned and the first lean-to glasshouses of iron were constructed. The latter are still producing peaches, early strawberries, irises and tomatoes.

The main glasshouse building programme planned by the Head Gardener of the day (Mr. McKellor) was started in 1902, at the beginning of the reign of King Edward VII, and carried through by an Edinburgh firm of contractors. These glasshouses form an extensive range, covering some 2 acres of vineries, peach and fig houses and special plant houses. Some of the latter are of the corridor type, divided into sections for differential temperature control. There are six walled gardens, including one extending to 8 acres, and a frame garden of 1½ acres. This comprehensive layout of half a century ago is uniquely recorded on a map in the present Head Gardener's office, together with a schedule of materials and equipment, including Cornish boilers, water

THE ROYAL GARDENS AT WINDSOR

storage tanks of 80,000 gallons capacity and over eleven miles of hot-water piping.

Modern Development The Royal Gardens are now adapted for commercial culture of crops and flowers, fruits and vegetables. This phase began in 1936, when some of the produce was disposed of by outside sales. During the war period the staff (mainly Land Girls) was reduced to a minimum and employed only to supply produce for the Household.

The entire area has been transformed during the past eighteen months under the direction of Mr. D. Stevenson. In particular, the many garden paths and familiar lines of fruit trees, which have always been a feature of country houses, have been removed to allow full mechanical operation.

Cropping All cultivations are today carried out by tractors. The open ground is cropped with strawberries (varieties, Royal Sovereign and Climax), summer cauliflowers, lettuce, early potatoes and winter brassicas. In future it is hoped to grow all the strawberries as an annual crop by planting runners in August and September. Lettuce is one of the major open ground crops, beginning with May Queen planted out in March, and followed by Trocadero Improved. This crop is one of the most profitable grown here. Early-flowering chrysanthemums are also grown on an area of 2 acres, which accommodates some 40,000 plants. Wallflowers and sweet williams are other specialities ; these are grown for one of the leading seed firms.

Frames The large area covered by frames is of great commercial interest. Many of the old English type have been superseded by the latest modern types on steel runners and so readily movable. The frames are used to produce lettuce, carrots, cauliflowers, radish and early potatoes. Chives and mint are produced for salad use all the year round. One-half of the area is heated by pipes, and had by late March produced one early crop of lettuce and early cauliflowers. When the lettuce seed is sown in frames, it is covered with a fine layer of sawdust. This produces a weed-free seedbed, and results in the plants standing up better during the cold weather. Arrangements are in hand to steam-sterilize the soil in the frames this year in order to destroy disease organisms which may be carried over in old frame soil.

Fruit One cannot write of the walled gardens without mentioning the wonderful wall of peaches, probably the longest of its kind in this country. On one garden the trees and soft fruit have been grubbed, leaving only the very old wall trees. Sodium chlorate at $\frac{1}{2}$ lb. a sq. yard was applied in late August—early September 1952, right up to the walls on which some of the trees are growing, and so far they have been unaffected by this treatment, which has given complete control of all weeds.

A small area of raspberries is grown, and the varieties Malling Promise and St. Walfried have given the best results. Rhubarb (variety, Champagne) is grown, but an area of a little-known variety, namely, Macdonald, is being tried out. This latter variety is of a beautiful red colour. A new orchard of 5 acres of apples is to be established in the near future and may well be planned as cordons, which Mr. Stevenson favours for this particular site.

THE ROYAL GARDENS AT WINDSOR

Glasshouses The main glasshouse crops are tomatoes, carnations, chrysanthemums, iris, peaches and vines. The peaches are now being arranged so that they are planted only at the back of the lean-to or three-quarter span houses. This allows the main part of the houses to be cropped with tomatoes, iris, or sweet peas. This latter crop is followed by chrysanthemums. The variety Loveliness is very popular and is plunged in 5-inch pots in June.

A succession of peaches is provided from May until November ; the main varieties are Duke of York and Peregrine, finishing the season with Golden Eagle. Grapes are also cut from early May onwards, beginning with Black Hamburgh and followed by Foster's Seedling and Madresfield Court. Pelargoniums, hydrangeas and arum lilies are also grown on a fairly large scale, together with freesias and delphiniums. Regal pelargoniums are a feature of this collection. Spring bulbs are also grown extensively for cut blooms. There is also a very fine collection of anthuriums, consisting of the two main species *A. Andreanum* and *A. Scherzerianum*. There are, however, four varieties of *A. Andreanum*. These brilliantly coloured flowers are a good selling line on the London market. The blooms are given special attention before marketing ; each is wrapped singly in tissue paper, and eighteen are packed into a chrysanthemum trunk.

Most of the chrysanthemums are grown in pots, but some are now planted direct into the borders in May. A popular variety for this treatment is Perfection (white).

Carnations have been grown in sand for the past ten years, using a dry-feed method introduced by a well-known Berkshire grower, Mr. F. Hicks of Wokingham. The results are very satisfactory, and unskilled labour can be used to do the watering. The tops of the beds are covered with gravel. The quality of the flowers and stems is not up to the very best grown in soil, but there is the advantage of freedom from Verticillium Wilt. The varieties grown are Princess Irene, William Sim, Ashington Pink, Peter Fisher, and Purity. At the end of the cropping period the sand is wheeled out and used for propagating chrysanthemums.

Labour It is interesting to look back at the labour force required in pre-war days, when the decorative side of the gardens was more important. In 1908 some 140 men were employed, in 1937 these had been reduced to 65 ; today 25 men form the entire working staff.

An interesting feature in the glasshouse area is the extensive bothy which, when built, was a model of its kind. It was one of the first improvements to be carried out after King Edward VII's accession. His special order was that it was to be used for educating the employees in the gardening profession, and "to elevate their tastes and habits". It has accommodation for twenty-four men, each having separate bedrooms, together with bathrooms and dining and sitting rooms. There are few such bothies now fulfilling their original purpose, and it is of special interest at this time that some fifteen young men are living in the original buildings and receiving first-class training in craftsmanship.

Royal Gardeners The Royal Gardens can claim to have had a number of famous and popular Head Gardeners in their long history. Amongst them was Mr. Owen Thomas, gardener to Queen Victoria, who retired in 1901, when Mr. McKellor came from the Royal Gardens at Sandringham to take over. He carried on until after the First World War,

THE ROYAL GARDENS AT WINDSOR

leaving in 1924. He was succeeded by Mr. C. H. Cook, one of the two distinguished brothers who served at both Sandringham and Windsor. During this period there was a good deal of co-operation between the two noted brother gardeners, which was well recognized by the Royal Family. In 1937, Mr. C. H. Cook was transferred to the Sandringham Gardens and Mr. G. Simpson took his place. He was in charge during the difficult war years, when a good deal of re-organization had to be made, and many crops discontinued. He retired in 1947. Mr. Stevenson, who was well known for his good work at the nearby Sunninghill Park Gardens, was then appointed. His work has been to develop the gardens on fully productive lines. In this, he has completely reorganized them to conform with present-day commercial practice. The task has been a big one, for not only is he responsible for supplying fruit and vegetables to Windsor Castle, for floral displays and frequent Court occasions, but also the normal daily problems of a large commercial market garden organized on truly intensive lines.

It will be realized that these gardens, like so many which began as a part of a large private estate, have passed through a period of transition. Their original object was twofold : the production of varied crops for home needs, and the provision of flowers and plants for decorative purposes. Although these requirements are still met, the gardens have moved with the times and are becoming increasingly commercialized. The land is now being cropped very intensively, and effective use is being made of the smaller labour force.

FARM AND ESTATE UNDER ELIZABETH THE FIRST

NIGEL HARVEY, M.A., Q.A.L.A.S.

It is interesting at this time to recall the position of agriculture under the first Elizabeth. Then, as now, increasing population posed a problem. But, in the sixteenth century there was a great deal of waste land still available for reclamation and cultivation, and the emphasis, therefore, was on changes in farming system rather than improvements in method.

WE are accustomed to regard the sixteenth century, the age of the Renaissance and the Reformation, of national consciousness and a truly national literature, as the time at which our own age came to birth. Henry VIII was the first modern man to sit on the English throne, and under his masterful daughter, Elizabeth I, England took for the first time an unquestioned place among the major European powers. Yet Tudor England did not wholly belong to modern times and, in particular, her farming still continued the older traditions of the Middle Ages. Change did, indeed, come to the sixteenth century countryside in violent and drastic form, but it was primarily economic, not technical, in character ; it rearranged rather than developed. New land, it is true, was won and new classes of men appeared, but the few new plants and tools which emerged were prophetic rather than immediately effective. The Old Farming served the England of Elizabeth, even as it served the England of Alfred.

FARM AND ESTATE UNDER ELIZABETH THE FIRST

The Winning of the Waste Yet it did so with increasing difficulty. Population, particularly urban population, was growing steadily, and both proportionately and absolutely there were more mouths for the farmer to feed. Thus London, greatest of all the "hungry centres," increased threefold or fourfold in size in the sixteenth century and by the year 1600 probably contained something like a twentieth of the total population of the country. But the ancient Waste, the traditional and obvious source of new farmland, was no longer the inexhaustible reserve of former times. In extent, of course, it was still considerable, but earlier reclaimers had cleared many of the more productive or convenient areas and the ship-builder and the wood-burning industrialist as well as the farmer were now taking toll of the primeval woodlands. It was, indeed, significant that, according to tradition, the last wolf in England was killed in the reign of Henry VII, the last wild boar in the reign of Elizabeth.

One sign of the times, therefore, was the shortage of timber which haunted the later Tudor economists. Another was the increasing interest in reclamation by drainage, for it is generally more costly and more difficult to rid soil of water than to rid it of trees. The sixteenth century saw, for instance, the embankment of the Wapping, Plumstead and Greenwich marshes, and the stock these newly-created grazings carried helped to serve the voracious London market. Here, however, the task was limited and returns reasonably secure, but by the end of Elizabeth's reign men were casting more speculative, more ambitious eyes at the sullen mass of the Fenlands, the largest and most forbidding area of primeval England that survived. The days of the Waste were numbered.

Nevertheless, in Elizabeth's reign its resources were still sufficient to blunt the edge of technical development. Reclamation still took precedence over invention, for it was only when the Waste was nearing exhaustion a century and a half after her time that men's minds finally turned from the expansion of the acreage cultivated to the intensification of methods used. The seeds of the agricultural future which this period contained are, therefore, more obvious to the historian than they were to the men of the time. It was, for instance, in Elizabethan days that the potato came to this country from America, but it was over a century before the new root passed from the rich man's garden to the farmer's fields.

Equally striking was the Tudor neglect of the turnip, that revolutionary plant whose coming to the farm was later to wreck the immemorial structure of the open field system. To the contemporaries of Shakespeare, the turnip was no more than a useful household vegetable, and none as yet suspected its economic importance. Meanwhile, in the background, the ancient challenge to which the turnip was to give so final a response still haunted the farmer. Tudor grass grew no more in winter than Saxon grass, Tudor hay lasted no longer than Saxon hay, and every autumn the annual slaughter still came to thin the farmer's herd and cripple the future before its time. "From Christmas to May weak cattle decay" ran the old proverb, and the use of ivy leaves for fodder recommended by one writer of the time shows to what lengths men were driven by winter scarcity.

The New Farming was still over a century ahead and it is significant that Tusser in the 1560s, like Walter of Henley three centuries before him, contented himself with summarizing the best contemporary farming practice he knew. Neither the one nor the other had anything fresh to offer the farmer.

FARM AND ESTATE UNDER ELIZABETH THE FIRST

Old Methods, New Men Technically, therefore, the Elizabethan farmer was little better equipped than his medieval ancestors. But the steady growth of a consuming public combined with political change to create an agricultural system more commercial and more directly concerned with financial profit than any known in previous times. The fall of the feudal nobility and the dissolution of the monasteries had cleared the agricultural way for the squire whose manor house represented a form of rural authority very different from that of castle or monastery. An Elizabethan official noted with satisfaction that "The country gentry, in former times wont to addict themselves to the wars, have now turned husbandmen and know as well how to improve their lands to the uttermost as any farmer," and the steady migration of urban wealth to the countryside reflected the opportunities of profit it now offered.

The "merchant adventurers, clothmakers, goldsmith's, tanners and other artificers" who bought farmland from "worshipful knights, honest yeomen and poor, labouring husbandmen," were familiar figures in this period. Such men expected from their estates neither the armed tenants nor the household rations of the older order. They wanted money, and their purposeful attempts to adapt the traditional farming system to more paying forms of production dominates the agrarian history of the sixteenth century. But in so doing they dealt harshly with the cultivators of the soil. For since wool paid better than corn, they turned flockmasters, and their sheep, taking possession of the ploughlands, drove many of the peasantry into economic exile as the homeless "rogues and vagabonds" who figure so prominently in both Tudor literature and Tudor legislation.

Yet the familiar story of the sheep-farmers, of the enclosure of arable land for pasture and the eviction of the peasantry through whose abandoned villages the shepherd and his dog passed as they tended the "man-eating sheep," of the riots, the protests, the fierce political literature and the legislation, is merely a variation on an old theme. The substitution of one form of farming for another and the spread of one known system over areas previously occupied by another altered the face of the countryside and the lives of men but it neither increased farming knowledge nor improved farming methods. Indeed, in one way it caused agricultural retrogression; sheep fattened on enclosed pasture were heavier and bigger than those ranches in traditional fashion on the hedgeless hills, but their wool grew coarser. In this period, therefore, certain grades of English wool were ousted from the Continental market by the finer Spanish produce. Nevertheless, these enclosures stand as a milestone in our rural history, for they were among the causes which brought to the farmlands for the first time the full power and purpose of the State.

The State and the Farmer For the enclosures threatened the production of corn, and the policeless Tudor monarchy, fearful of "belly-bred" rebellion, devoted a considerable proportion of its considerable executive power to maintaining the arable acreage and checking "the pulling down of villages and the putting away of ploughs". Elizabethan parliaments passed four statutes to control enclosures, but even so there was continuous local trouble, including a minor peasant rising in Oxfordshire in 1596. This legislation, however, was but part of the general Tudor policy of securing the national food supply. For instance, the Government controlled the distribution of corn by regulations codified so minutely that the headings alone of the "Book of Orders" which contained them takes three pages of a modern book. By the same token, when certain Elizabethan

FARM AND ESTATE UNDER ELIZABETH THE FIRST

farmers started growing woad so that they could make at home the dyestuff which until then was imported from abroad, the Government restricted the acreage occupied by the new crop. Industrial raw material, however valuable, could not be allowed to usurp land which should be growing food. Similarly, the commercially-minded Crown favoured the export of corn but allowed little to go overseas until the needs of the realm were first satisfied. In the days of Elizabeth, the consumer came first and in his interest producer and distributor alike were controlled by statute, commission and pervading administrative action.

Rise of the Surveyor The official, however, was but one of the new figures who established themselves in the agrarian economy of Tudor England, for in this violent and complicated age the medieval hierarchy of seneschals, clerks and bailiffs could no longer meet the administrative demands of farm and estate. In particular, there was constant and increasing need for the measuring and mapping of land, for the more exact assessment of rent, for the division of old farming units and the creation of new, for records of sale and purchase, and for the greater security of legal title. Hence the development of the surveyor who came of professional age in the reign of Henry VIII, when the first two English treatises on surveying appeared in print. And the status of their authors was significant; one was a judge, the other an ecclesiastic who was also a royal official.

Men of this type were more than mere measurers, and the importance of their profession was greater than its limited title implies. Some of these surveyors became valuers and agricultural consultants, others turned land agent and served landowners rather than farmers. Saxton, the cartographer, for instance, made surveys of estates as well as shires and even found time to act as a rent collector. More typical, because less specialized, was that other Elizabethan, Ralph Agas, who is best remembered today for his superb perspective drawings of Oxford and Cambridge. He, too, was primarily a surveyor. He was, indeed, one of the first men to use the theodolite, and his numerous clients included Lord Burghley, Elizabeth's great minister, at whose request he undertook certain mapping work in the Fenlands. But he was equally at home in the office, and his knowledge of tenures and tithe, of "reading, calendring and retrieving" old documents and the "quickenings and revising" of rents, dues and privileges earned him various administrative employments under the Crown. Indeed, the rise of the surveyor is one of the significant features of this rural period, and the premature suggestion of the 1580s that surveyors should form themselves into a corporate body to enforce proper standards of training bore striking witness to the rising status of this profession.

But this professional development also reflected the agricultural limitations of the age. The surveyor was sometimes the agent of reorganization, sometimes of more intensive management, seldom of technical advance. He measured, mapped, and assessed land; only indirectly did he improve it. We look in vain in the Elizabethan age for the improving landlord, for the agricultural engineer or the agricultural scientist. The driving necessities of food production which were later to call these men into economic existence had not yet come. The subjects of Elizabeth Tudor did great things, but the challenge of their time was insufficient to compel them to devote their energies and genius to the radical improvement of the farming system they inherited.

THE CROWN LANDS

J. A. HILLMAN, B.A.

Assistant Commissioner of Crown Lands

There are approximately 379,000 acres of Crown Lands in the United Kingdom, of which 196,000 acres are in England, 78,000 in Wales and 105,000 in Scotland. They are widely varied in their character but have a strong agricultural importance.

THE Commissioners of Crown Lands manage the hereditary possessions of the Crown. In origin, these possessions are the ancient Crown lands which came into the hands of the Sovereign in various ways. In early times the income from these lands was used to defray the normal expenses of the King's government: the King was expected to summon Parliament to vote special subsidies only in abnormal circumstances, such as foreign wars. Some of the Stuart kings, in consequence of disagreement with Parliament, were reluctant to summon it even when faced with foreign wars, and they resorted to the practice of extensive selling and mortgaging of Crown lands in order to raise money to meet extraordinary expenditure. As a result, by the time of Queen Anne the hereditary possessions had reached so low an ebb that Parliament began to exercise control over the alienation of Crown lands. By the middle of the eighteenth century it was clear that the receipts from the Crown lands were quite insufficient to meet even the ordinary expense of government, and George III began the practice, followed by all his successors, of surrendering to Parliament the income of the hereditary possessions during his lifetime in exchange for a fixed Civil List.

Early in the next century the Crown lands were placed under the management of the Commissioners of Woods, Forests and Land Revenues; the name was changed to Commissioners of Crown Lands in 1924, following the transfer of the Crown woods and forests to the Forestry Commission after World War I. It is, of course, only the income which is surrendered to Parliament; the lands remain vested in the Crown. The Commissioners are therefore in the position of trustees for the Sovereign as regards the capital of the hereditary possessions, and for Parliament as regards the income.

Estate Management for the Crown Some of the lands for which the Commissioners are now responsible are very ancient hereditary possessions of the Crown; for instance, parts of the London and Windsor Estates. But this is by no means so as regards all the present Crown Estates, a number of these having been purchased in recent times. The Commissioners look after the lands under their charge in the normal way of good estate management. Occasionally land is sold, as in the case of Crown land required for some public purpose such as local authority housing. A substantial accretion to the capital resources of the Crown came from compensation for royalties on undersea coal. It is the statutory duty of the Commissioners to reinvest in land, as soon as a suitable opportunity occurs, capital arising from such sources as the compensation for the coal royalties and sales of Crown land. Among interesting purchases made by the Commissioners in recent years are the former Portman Estate at Taunton in Somerset; a large part of the Savernake Estate, Wiltshire, which was granted by the Crown to Protector Somerset in 1547; and the Dunster Castle Estate, Somerset, which had been in the hands of the Luttrell family since the fourteenth century.

THE CROWN LANDS

The Crown lands under the management of the Commissioners now produce a gross income in rents and other receipts of over £2,458,000 a year, and out of this income the Commissioners, in the last financial year, after meeting all expenses of management, were able to pay into the Exchequer, in aid of taxation, a sum of £980,000. These lands, totalling about 380,000 acres, are of great variety. In London, among very many properties, may be mentioned Regent Street which, with total annual rents of over half a million pounds, is from the financial point of view the most valuable of all the Crown properties; John Nash's Carlton House Terrace and Regent's Park terraces; the Pall Mall Clubs, and the Zoo. The Commissioners also have in London two housing estates managed on Octavia Hill lines; one, of blocks of flats erected in the nineteen-thirties, is at Cumberland Market, near Regent's Park, and the other, of modernized nineteenth century houses, is at Millbank not far from the Tate Gallery.

There are extensive residential estates at Eltham on the borders of London and Kent and at Oxshott in Surrey. On the former estate there still stands the fine Great Hall of the ancient royal palace of Eltham, and nearby are some interesting sixteenth century wooden-fronted houses which are being reconditioned by the Commissioners. At Hampton Court and Richmond, where the Crown has owned land for centuries, are some good specimens of period houses, including the house at Hampton Court where Sir Christopher Wren lived for many years and eventually died. There are Crown lands at Dover, Hastings, Portsmouth and Gosport and in the Isle of Portland.

The foreshore, that is the shore between high and low water marks, round our coasts belongs to the Crown, except where some subject can show title, e.g., under a past Royal grant. The Crown foreshore, which is very extensive, is under the charge of the Commissioners. Wherever practicable they grant a lease to the local authority which is thus put in a position to regulate the use of the foreshore in its area. The royalties from coal, as already indicated, have been extinguished, but there are other minerals remaining under the Commissioners' charge particularly in Wales, some of the best slates and road metal in the British Isles being produced in Crown quarries in Caernarvonshire.

Brief mention may be made of the Crown property under the Commissioners' charge in Scotland. This extends to over 100,000 acres in half-a-dozen different counties, comprising agricultural lands and large areas of moorland used for sporting (principally grouse shooting) and forestry purposes. There are also salmon fishings, both in the sea and in rivers.

Widespread Agricultural Interests The agricultural estates in England managed by the Commissioners cover altogether an area of about 155,000 acres situated in twenty-six different counties, stretching from Lancashire and Yorkshire in the north to the Isle of Wight in the south. There is considerable variety in the value of the land, in the nature of the soil, and in the type of agriculture pursued. In Yorkshire there are several estates, including Boroughbridge in the North Riding and Ottringham, Patrington, Sunk Island and Swine in the East Riding. At Ottringham the Commissioners have farmed 650 acres in hand very profitably for a number of years. The Sunk Island Estate is in an exposed position on the Humber Estuary: it is corn-and-beef producing land. In Lincolnshire there is a block of estates in the fenland area between Sleaford and Bourne: on these estates is the site of the Abbey of Sempington, a house of the Gilbertines, the only monastic order founded in England. There are two bulb farms near Spalding. Then on the borders

THE CROWN LANDS

of Lincolnshire and Norfolk, round about the Wash, is some of the most highly rented agricultural land under the Commissioners' charge. One of the estates here is Wingland, to which nearly 700 acres have been added by a reclamation scheme, involving the construction of a new sea-bank, carried out by the Commissioners in 1951 at a cost of £66,000. The Commissioners are now working on plans for another scheme, which should result in the reclamation of a further 650 acres from The Wash. The land just behind the new reclamation was itself reclaimed with prisoner-of-war labour during the 1914-18 war.

In Leicestershire is the Gopsall Estate, purchased by the Commissioners about twenty years ago. Jennens, who furnished Handel with the text of *The Messiah*, lived at Gopsall Hall, the mansion house, now demolished, and Handel himself often stayed there. This estate used to suffer from a serious water shortage almost every summer but a few years ago the Commissioners, with the aid of a grant from the Ministry of Agriculture, brought a mains water supply to the estate and laid it on to the various holdings.

At Holmewood in Huntingdonshire, not far from Peterborough, an estate recently purchased, the Commissioners have carried out a big claying operation with a view to increasing the productivity of the farms. The Gorhambury Estate is in Hertfordshire between St. Albans and Redbourne; the remains of the Roman Verulamium are near the southern boundary of the estate, and the River Ver intersects it.

The Wychwood Estate in Oxfordshire is situated mainly on high ground, above the valley of the River Evenlode. The land is not so valuable as that of most other Crown Estates, but it is in pleasant Cotswold country. The Bishops Cannings Estate in Wiltshire runs up to the Downs near Marlborough and looks across to Avebury and Silbury Hill. Productivity of the downlands on this estate has been much increased during and since the last war, and experiments have been made with improved grass cultivation. Parts of the downlands are used as gallops in connection with the well-known Beckhampton Stables, which are a near neighbour of the estate. Poynings, in Sussex, is another estate situated largely on downland. It is on the north slopes of the South Downs behind Brighton, and runs down to the villages of Poynings, Fulking and Edburton (which has an interesting church). There are two golf courses on this estate. The main farming is milk production. Near the Devil's Dyke was the terminal station of the old Dyke railway which used to bring visitors up to the Downs from Brighton. The railway was closed some years ago; the site of the station has since been bought back by the Crown and added to the surrounding farmland, and a set of new farm buildings has been erected on it.

Bedgebury, on the borders of Kent and Sussex near Tunbridge Wells, is the only estate under the Commissioners' charge in hop-growing country. On this estate is Twysenden Manor, an interesting old house with wall paintings and a priest's hole, once the refuge of recusants: it is now let to the Youth Hostels Association. The other estate in Kent, the low-lying Neats Court in the Isle of Sheppey, suffered in the recent flood disaster. In the west country, there are in Gloucestershire the Hagloe Estate, from which there is a grand view of the Severn Estuary, and the Clearwell Estate adjoining the Forest of Dean. An outlying property of Clearwell is St. Briavels Castle, which stands in a prominent position on high ground overlooking the valley of the Wye: this is another interesting building of which the Youth Hostels Association are the Commissioners' tenants. In the Wye Valley itself is the Tintern Estate, set in grand scenery around the

THE CROWN LANDS

ruins of Tintern Abbey. The Abbey itself is now in the care of the Ministry of Works.

Mention has already been made of the Dunster Castle and Taunton Estates in Somerset and the Savernake Estate in Wiltshire. Other counties in which there are agricultural estates in the Commissioners' charge are Bedford, Buckingham, Cambridge, Cheshire, Dorset, Essex, Lancashire, Northampton, Nottingham, Surrey and Warwick. Enough has been said to show the widespread nature of the Commissioners' agricultural interests. There is also variety in the method of local management of the agricultural estates. Some are under the charge of full-time salaried professional officers of the Commissioners with local offices and staffs ; others of private firms of land agents paid by commission on the total rents which they collect. Much work has been done since the war on providing new farm cottages and buildings and in modernizing existing equipment ; two other estates in addition to the Gopsall estate have had mains water brought to them.

Windsor At Windsor the Commissioners' interests include the management of the Home Parks and the Great Park and of considerable areas of woodlands in the Ascot-Bagshot district, with a variety of other properties, including Ascot Racecourse, the Berkshire Golf Club, house property in Windsor town, and a number of farms let to tenants in the ordinary way. The whole is under the local management of Mr. E. H. Savill, the Deputy Ranger of Windsor Great Park, whose office is by the Prince Consort's workshops in the park.

The woodlands extend to about 6,000 acres and carry very valuable crops ; many of them are young plantations growing into money, but sales of mature timber, particularly for telegraph poles, bring in a considerable income every year. Windsor Great Park contains about 4,500 acres. The public are normally at liberty to walk in a large part of this beautiful park, including the Valley Gardens on slopes running down to Virginia Water, where lovely displays of rhododendrons and azaleas are to be seen. There is also being assembled a comprehensive collection of rhododendron species which is of great interest to botanists and horticulturists. On the east side of the Great Park are the Savill Gardens—so called by command of His late Majesty, King George VI. Their creation is due to Mr. Savill. This is a lovely place, full of fascinating plants of great variety of colour and species.

Finally, reference may be made to the big farming activity in the Great Park. It was started in the early days of the last war and now covers some 2,000 acres, about half of which is under the plough each year. Here the Commissioners again appear in the role of farmers, for this large area is farmed in hand under the direction of Mr. Savill and his chief assistant, Mr. Lindsay. From the start combine harvesters have been used, and a grain drier was early installed. More recently a grass drying plant has been added. There is a pedigree Friesian dairy herd with about 65 milking cows. In the stock-rearing department several hundred head of cattle are being brought on for beef. There is also a large department of pedigree Wessex Saddleback pigs. The Commissioners often have prize-winning exhibits at agricultural shows, and they headed the Berkshire list for Friesian herds of ten or more cows in the National Milk Board's Southern Region Report for 1952. Windsor Great Park is, therefore, making a substantial contribution to the nation's food.

RESEARCH FOR PLENTY

No. 8. NEW FOODS FOR A CROWDED WORLD

N. W. PIRIE, M.A., F.R.S.

Rothamsted Experimental Station, Harpenden, Herts

THE earlier contributors to this series have described many ways in which new knowledge has affected, or could affect, food and agriculture. If their proposals were acted on vigorously, the present world food shortage could probably be abolished. But there would be only just enough food for the present population ; and the population is likely to grow. Possibly, increasing urbanization and improving standards of living may cause a fall in the rate of increase, and there may sometime be a stable population, but we dare not assume this and we do not know how large the stable population is likely to be. All improvements normally advocated should therefore be pushed on with ; that may solve the immediate problem. But, at the same time, thought and experiment are needed on the problem of feeding the world population if it goes up from its present value of rather over two thousand million to four or six thousand million. If we have this number to feed, a radical reconsideration of the processes of agriculture and food-making will be called for. At the same time, we might think about the advantages of keeping the population from becoming so large. That course presents difficulties, too, but with reasonable research facilities it should be possible to devise socially-and aesthetically-acceptable contraceptive techniques so that the invariable reason for the birth of a child is that that child is wanted. When children are no longer conceived inadvertently, we may well be concerned with under- rather than over-population.

The basic research on foodstuffs was done by primitive man some thousands of years ago. Plants and animals were examined to see whether there was any part that could be eaten with satisfaction and safety, and the better species were cultivated and improved. Recently the rate of improvement has increased, but the process, in essence, remains the same and research is mainly directed towards getting a greater total yield of one of the conventional products, or at increasing the proportion of a plant or animal that is edible. It is likely that, with the familiar domesticated animals, this process has about reached a limit, but, as Dr. Alan Fraser explained,* there are many animals that have not been subjected to careful selection. Fish have hardly been selected at all. But the most important improvements are likely to come from increases in the useable portion of plants ; for the plant is the fundamental food on which both land and water animals depend.

Of the half million or so known green plants, only a few hundred are used on a significant scale and many of these are only used indirectly. They are fed to animals and we eat the animals. But many of the others grow luxuriantly. Gardeners know well how readily weeds grow, but a plant is only a weed for as long as we have no use for it. If we wished simply to have the largest possible amount of vegetable matter, many other plants—even in their uncultivated state—would be as good as our domesticated plants. With a little attention and breeding, they might even be better. But we will have gained nothing if we make a great mass of vegetation that neither man nor beast will eat.

* *Agriculture*, 1953, 60, 10-4.

That then defines one problem : what are the essential differences between edible and inedible plants or parts of plants ?

Inefficiency of Animals in Converting Leaf Protein The higher green plants, when they are growing vigorously, have similar general structures. A root system in the ground collects water and simple nutrients, and a leaf system traps light and collects carbon dioxide from the air. The process is driven by the energy of sunlight. Plants expose their leaves to light and air very efficiently, but the exposure can only be effective if the plant is protected from damage and supplied with water and nutrients. The primary aim of the techniques of agriculture is to ensure this. Basically, improvements in husbandry are designed to increase the efficiency with which water, light and carbon dioxide are united in the leaf. On this process almost all life depends.

The process, like most biological processes, works through an integrated group of enzymes, and enzymes, so far as is known, consist mainly of protein. Whether we use a plant as a source of seeds, tubers, fibre or latex, and whether the product we get from it contains protein or not, the plant makes leaves first and the other things from the leaves ; the leaf is its factory and proteins are the tools in the factory. In the normal development of the mature plant the protein moves out of the leaf and reappears in the seeds or tubers that we eat. Similarly, when an animal eats the leaf it converts leaf protein into meat or milk. Dr. Norman Wright* discussed the conversion into meat or milk and explained that the merit of the ruminant animal is that it can also digest the fibrous parts of many types of leaf and so use the fibre as a source of energy. But these conversions are inefficient because for every 100 lb. of leaf protein that the cow eats we only get 20-30 lb. back in the milk when she is in milk, and only 5-10 lb. back as meat from beef cattle. It is sometimes argued that the process is not really inefficient because all the nitrogen of the protein goes back on to the land, nourishes it and reappears in the next crop. In part this is so ; elements are not destroyed during agricultural operations. But there is waste of effort if nitrogen or protein goes fruitlessly round a cycle without being intercepted and eaten by us. It is as if a fisherman laboriously netted fish on one side of a ship while a colleague shovelled nine-tenths of the fish back into the sea over the other side. In a sense the fish are not being wasted ; the fisherman can always catch them all over again. But no one would argue in favour of this as a good technique of fishing.

One way to avoid this inefficient cycle, and so get more human food for the same amount of agricultural effort, would be for us to eat leaves too, and it would undoubtedly be possible for people to eat more leafy material than they do at present. But not much more. The ideas attributed to Nebuchadnezzar and Joseph Foulton are not very good ideas, and leaves are likely to go on being condiments rather than foodstuffs. Unsuitable as the leaf may be for direct human consumption, there is good reason to think that protein, glucose and other foods could be made from it in nutritious and palatable form in a factory. Ultimately this will be done with special crops grown for the purpose, but work of this type should start using the ample supplies of forest and agricultural waste that we already have. All the rubbish that is normally burnt or rotted is potentially useful.

Another problem can therefore be defined : could we take leafy or woody material that is at present either not being grown or is being thrown away when grown, and convert it on a large scale into palatable food ?

* *Agriculture*, 1953, 59, 559-63.

RESEARCH FOR PLENTY :

New Ways of Food-Making In the laboratory those things are easily done.

In the factory glucose has already been made from wood by several different processes, and attempts to improve these processes are being made in several countries. So far, no sustained work on an adequate scale has been done on the extraction of leaf protein, but a beginning has been made, and the preliminary tests of machines for grinding fresh leaves and pressing out part of the protein in the juice, have been very encouraging. It already seems certain that such a process will be both possible and useful. If it is going to be done sometime it might as well be done now, but this will involve very much more extensive research than is at present envisaged. The way to avoid the sometimes unfortunate impact of science on daily life is to do the research more thoroughly and to start it before the need is urgent. The defects, if any, can then be discovered and corrected in the privacy of the laboratory, whereas if the work is done hurriedly it may be applied before it is complete. The people of Britain should not be experimented on. They do their share by supplying the money and, through their fecundity, the problems. They should not be used unnecessarily as guinea-pigs as well.

So far I have argued the case in negative terms : because the world is short of food, materials are worth making as food on a large scale if they are digestible and do not have objectional flavours or textures. But eating is not simply a matter of fuelling the body. We expect it to be fun, and, to a large extent, digestion depends on that expectation being fulfilled. The third question, therefore, is : could we turn materials made in the manner I have outlined into good, as well as useful, foods ?

Given time, it is certain that we could, because the materials themselves are adaptable and so is the human appetite. Do not misunderstand me. I am not looking forward to these new foods. When it comes to eating I am as conservative as anyone else, but we must accept the fact that without wholesale slaughter of the world's population, the old ideal foods are unlikely to come back in quantity. The foods of which we think nostalgically—steak, roast beef and so on—have never been more than the foods of a favoured minority in a favoured country. They have not been the foods of the large aggregations of population, and it does not seem likely that we will re-establish sufficient commercial ascendancy to enable the whole population of Britain to eat the pre-war middle and upper class diet. Regretfully, therefore, I turn to what most of the world has always eaten. Rice, wheat, maize, potatoes and other starchy foods enlivened with a little meat, fish and fat, and with a range of herbs to give flavour ; that is the world's diet, and if the population goes up it will be ours too. Leaf protein would improve such a diet greatly and, at the worst, would not be noticed in it.

Glucose and leaf protein are only two examples, but there are many others. Such possibilities are sometimes criticized on the grounds that they are artificial and unnatural. They are : but so are most of our present foods. Our foods are as artificial and sophisticated as our clothes and there is no more reason to think we have reached perfection with the one than with the other. Even if there was no necessity to find *more* food, it is likely that new materials would alter our foods as they have already altered our clothes.

During the last decade several new foods have figured in the British diet, and some of them have been received coldly. This is partly because they have been looked on as temporary expedients—something to tide us over an awkward shortage. Those interested in the preparation of food have not therefore thought it worth while to concentrate on making from them something really tasty in its own right. The position would be different if we

No. 8. NEW FOODS FOR A CROWDED WORLD

were persuaded that things like this would always be with us, and if the cooks were convinced that the new foods would be the basis of their operations during the foreseeable future. Thousands of years of skill and accident lie behind our present cooking and eating habits, and it is not to be expected that novel products will be handled effectively right away. Intermittent effort over many years is likely to be called for. But when we consider the surprising variations that local enterprise has given to cheese in France and Italy, or to fish in Scandinavia and the Far East, or to fermented and unfermented drinks everywhere, there is no reason to think of any material as unredeemably dull. If the project looks difficult, there is all the more reason for starting work on it early before the need has become acute.

Agriculture and cooking are old and traditional skills. Even minor changes in them are resented fiercely for various reasons, and the resentment is, in part, justified. An innovator is apt to be preoccupied with his own facet of a large problem and does not always pay due attention to all the consequences of a change. We have had many examples of this, and the cynic is apt to say that with every advance of science something becomes a little worse, or some process a little less satisfactory. Sometimes, however, scientific advance opens up new and widely welcomed possibilities; the control of electricity is an obvious example. Then science does not produce a cheaper substitute for something we already know and like. Then the change is important not as a substitution but as an innovation. New types of activity become possible which the innovator thinks people will enjoy, and the innovator is often right.

What are the best Raw Materials? My thesis is therefore simple. An intensification of the familiar processes of agriculture could overcome the present shortage but would not cope with probable future demand; that could, however, be met if high-yielding leafy crops were used as the raw material for a biochemical engineering industry. This thesis is not generally accepted. There are those who take a gloomier view of the present; but the other contributors to this series have dealt with them. There are those who agree that technological advances have opened up new possibilities, but who do not think that the leaves of higher plants are the best raw material for the work. Some would start with coal or limestone and the nitrogen of the air, and make wholly synthetic foods; others would concentrate on bacterial and fungal synthesis; and yet others would use the single-celled green plants. The objections to those views can be stated briefly.

At the end of his talk, Sir James Scott Watson* indulged in what he called "a pleasant dream" of the chemist in the factory making all the basic foods like starch and sugar while the farmer concentrates on the dietary frills. It is a possibility certainly, and undoubtedly a wider range of things will be made synthetically. Fats and vitamins are already; some of the amino-acids—the building blocks of which proteins are made—could be made, and could be used to supplement proteins that happen to be deficient in a particular amino-acid. But I doubt if more than a small fraction of our food will be synthesized directly in this way. What would be the point, unless starvation threatens otherwise? Under good conditions farming is as pleasant a job as factory work, and it uses the free energy supply of sunlight. This is the real difficulty; the raw materials are abundant, but for large scale synthesis we would need enormous amounts of energy, and

* *Agriculture*, 1952, 59, 351-5.

RESEARCH FOR PLENTY

the possibility of the exhaustion of our coal supplies is already causing alarm. Nuclear fission might help, but solar energy is more probable. The leaf already uses this. While it is obviously wise to look for other methods of trapping sunlight, the possibility of simply making the leaf more efficient should not be lost sight of.

Bacteria and fungi could be a source of food but they need some form of organic soup to grow on. For as long as we only think of small-scale production there are many wastes that could be used; but for large-scale production, by-products would not suffice and we would have to grow crops deliberately to feed the micro-organisms. This would sometimes be an advantage but more often it would involve precisely the type of wasteful conversion that we are trying to avoid. The single-celled green plants have the great merit that they use our undiminishing asset—sunlight—as the source of energy and then, like any other green plant, unite water, a nitrogen source, and carbon dioxide. But they seem to have no merit that the higher plants lack. They do not make an accustomed food but only the raw material for biochemical engineering; they do not grow in the open on fields but in tanks and tubes of comparable acreage. The capital outlay and the aesthetic results of such a conversion of the countryside are alike alarming. It is true that when pampered ideally in the laboratory they give a greater yield per square yard per hour than we get by normal farming, but no one has tried pampering the higher plants in the same assiduous and expensive way. Where we have sunlight, soil and fresh water, we are not likely to improve on the leaf; where we lack soil, water culture could be used; where we lack water, things become more difficult. It may be that sunlit deserts could advantageously be used to grow single-celled plants. Each technique has its place and there is probably a most efficient use to which each area or waste product could be put. The various processes should be looked on as complements rather than alternatives.

A Plea for Food Research If, therefore, imaginative, long-range research is undertaken soon to discover how to make a wider range of agricultural products into human food and how to give novel materials pleasing flavours and textures, the outlook for world feeding during the next hundred years or so seems hopeful. The food eaten in Britain is likely to be different but not necessarily worse; that eaten in much of the rest of the world should improve. If the proposals made by the earlier contributors to this series are carried out, the world could have a brief respite from hunger, but it will not be long before pressure of population catches up with us. Ultimately there must be a population limit, and establishing conditions for a stable population throughout the world will be a slow business. It is urgent, therefore, for radical research on food production to start. With sufficient luck and skill, the research may keep human fecundity from being a threat for several generations, and after that interval the problems will probably be quite different from those that we recognize now.

(Copyright reserved to author)

This article completes the series

THE ENGLISH ROSE

A. H. HOARE

The Rose doth deserve the chiefest and most principall place among all floures whatsoever, being not esteemed only for his beautie, virtues and his fragrance and odoriferous smell, but also because it is the honour and ornament of our English Sceptre, as by the conjunction appeareth, in the uniting of two most Royal Houses of Lancaster and York.

John Gerarde, *The Herball*, 1597

IT is difficult to write impersonally about the rose, for this flower, the national emblem of England, has been associated with mankind since the days of King Solomon and seems to bring to each generation a personal appeal. Where roses are concerned, we are impressionable. Often, we fall under the spell of the magic of the rose early in life. For my own part, I can say that fifty years of keen interest in the development of modern roses have not effaced the memory of the roses that climbed the walls of my boyhood home. They were the old Noisette climbing roses, *Gloire de Dijon* and *William Allen Richardson*. I remember, too, the old garden, where the Provence or Cabbage roses, beloved of my grandparents, competed for living space with the rampant shrub-like Hybrid Perpetual roses that were my father's favourites.

In those early days we used to grow, or try to grow, the exquisitely perfumed Tea-scented China roses, and I became particularly fond of them. I confess that much as I admire the modern Hybrid Tea (which I suppose we can call the real English rose), I have a lingering regard for the Tea rose, my first love of the great *Rosa* family. Those delicate pastel shades and that delightful yet elusive perfume, like the fragrance of China tea or sun-warmed, ripe apricots, has always remained with me.

As I have hinted, the Teas were difficult to grow under English conditions, but my reward was to come in 1910 when I went to work in the West Indies. Tea roses flourished in the "hot-house" temperature of Jamaica; the bushes bloomed almost the whole year round. I have retained a vivid memory of those floriferous beds of *Maman Cochet*, *Helen Good* and *Lady Hillingdon* in the Hope Botanical Gardens. There was no trouble with propagation, for cuttings taken from the bushes quickly struck root in the humid climate of Castleton Gardens in the hills about twenty miles from Hope.

Evolution of Modern Roses The rose has made history in England. But four hundred years ago, when the young princess who was to become Queen Elizabeth I of England was spending her days at Hatfield, the roses then grown in English gardens were few. It is doubtful whether they were other than selected forms of our wild roses of hedgerow and woodland. But those were the roses William Shakespeare knew as a boy, the roses he remembered as a man and wove into his sonnets and plays, the Dog Rose, Field Rose and Eglantine (Sweet Briar) of the sequestered banks around Wilmcote where his mother, Mary Arden, had lived before her marriage to his father John Shakespeare. But both Queen Elizabeth and Shakespeare lived to see the coming into England of the fragrant Damask Rose in 1573, the Provence Rose, the Moss Rose and the French Rose in 1596, followed by the White Rose in 1597.*

* These are the dates given by Miller.

THE ENGLISH ROSE

These immigrant roses helped to grace the gardens of the Elizabethan period when ornamental gardens became fashionable. But always they were roses of June ; their beauty was fleeting, and in those days one could truthfully have sung, " This is the last rose of summer". The continuous blooming quality of the rose was not seen in England until after the China roses were imported from the Far East in 1789. The China roses were first crossed with the Provence, French and other summer roses and then by further breeding from the hybrids so obtained the so-called Hybrid Perpetual race of garden roses was developed. Mostly these roses grew vigorously, making shrubby bushes up to 5 feet high, and gave an extended but not a successional production of flowers. Although the name " Hybrid Perpetual " was a misnomer, a few of this group are still grown as shrub roses, *Frau Karl Druschki*, *George Dickson* and *Hugh Dickson* being notable examples.

The Hybrid Teas, the new race of roses obtained by crossing Tea-scented Chinas with Hybrid Perpetuals and inversely, first appeared late in the nineteenth century. It was soon clear that we were on the track of the ideal English rose. Time has proved it true. Of hardy constitution, not excessively robust, the varieties of this hybrid race grow to a height of 2-3½ feet, according to variety and cultural treatment. They bloom from about mid-June until stopped by the onset of winter, normally in three well-defined flushes with incidental flowers between, so that there are always roses in the garden. In nearly all varieties the flowers are double and of perfect shape ; and although most varieties are fragrant, the type of perfume varies considerably, disclosing thereby the complex character of this rose's ancestry. The main colours of the varieties are white, yellow, orange, red, carmine, pink and blush, with many combinations of two or more shades of each.

The advent of the Hybrid Tea rose made possible the carefully designed rose-garden, with its beds of massed varieties. A fine example of a modern rose-garden can be seen in Regent's Park in the heart of London—the Queen Mary Rose Garden established in 1935, the year of the Silver Jubilee of King George V and Queen Mary.

The Hybrid Tea rose was welcomed also as a good type of florist's flower and led to the development of commercial rose culture under glass. The richly scented pink shaded *Madame Butterfly* (E. G. Hill, 1918) and its creamy rose-pink "sport" *Lady Sylvia* (Stevens, 1927) have been outstanding examples of roses for commercial culture.

At the time the Hybrid Perpetual rose was engaging attention of rose breeders, another type of rose was being developed. This was the Polyantha rose, which first appeared in 1875 as a development of *Rosa multiflora* (a climbing rose from Japan) crossed with China and Tea-scented roses. During the present century the Polyantha rose has been further developed by crossing with others, Hybrid Teas and Wichuraianas for example, so creating a new hybrid race of roses of considerable diversity. This section comprises two classes—the Dwarf Polyantha and Hybrid Polyantha, known nowadays also as Floribunda. *Ellen Poulsen* is an example of the former class and *Frensham* an example of the latter. The Polyantha roses have the prolonged and free-flowering habit and great range of colours seen in the Hybrid Tea roses—qualities making them suitable for the massed beds of rose gardens. They have insufficient value as a florist's flower to interest the commercial grower.

The remaining group of roses of particular interest are the climbing roses. Today about half of the climbing roses are climbing "sports," somatic variants of well-known Hybrid Tea bush roses ; there are about thirty of

THE ENGLISH ROSE

these "sports" in general cultivation. The remainder consists mainly of Wichuraiana roses, a type originally imported from Japan by Dr. Wichura, and Noisettes, a type originally raised by Philippe Noisette from seed of the old Musk Rose, *Rosa moschata*, the flowers of which had been fertilized by the common China rose. In the Noisettes perfume has always been pronounced, being handed on to later generations including those that won my youthful affection, *Gloire de Dijon* and *William Allen Richardson*. As for the Wichuraiana roses; everybody knows *Emily Gray* and *Paul's Scarlet Climber*, both roses of this type raised in England nearly forty years ago and which are still favoured for garden culture.

The Pernetiana roses should also be mentioned; these came from a type originally raised by a Frenchman, M. Pernet-Ducher, by crossing the old Persian Yellow rose with a Hybrid Perpetual. This hybrid type developed into an attractive sweet-scented section but gradually merged into the Hybrid Tea section so that the name came to be dropped. The Daily Mail rose, *Mme. Edouard Herriot*, which created quite a sensation in 1912, was one of the Pernetianas. We should, however, remember these roses, for they contributed to the final development of the Hybrid Tea and Hybrid Polyantha roses.

An attempt has been made briefly to outline the development of modern roses. Looking back over a century, we must acknowledge the value of pioneer work carried out by English rose breeders of the nineteenth century (among them Thomas Laxton of Bedford, Thomas Rivers, of Sawbridge-worth and William Paul of Cheshunt) whose experiments enabled later work to continue progressively until the ever-blooming, colourful Hybrid Tea rose had been achieved.*

The following twenty varieties of Hybrid Tea roses, given in chronological order, are particularly fine examples of this class:

- Ophelia*: Blush pink, Paul, 1912.
- Etoile de Hollande*: Rich crimson, Verschuren, 1919.
- Mrs. Henry Bowles*: Rose-pink, Chaplin 1921.
- Betty Uprichard*: Salmon, Dickson, 1922.
- Shot Silk*: Salmon-orange, Dickson, 1924.
- Lady Sylvia*: Creamy rose-pink, Stevens, 1927.
- Polly*: Cream, shaded gold, Beckwith, 1928.
- Mrs. Sam McGredy*: Coppery-orange, McGredy, 1929.
- Picture*: Light rose, McGredy, 1932.
- McGredy's Yellow*: Primrose-yellow, McGredy, 1933.
- Phyllis Gold*: Golden yellow, Robinson, 1934.
- Mrs. Edward Laxton*: Old rose and orange, Laxton, 1935.
- The Doctor*: Rose-pink, Howard and Smith, 1936.
- Peace*: Pale to deep yellow splashed red, Meilland, 1942.
- Prima Donna*: Coppery-orange, Dickson, 1944.
- Fantasia*: Bright yellow, Dickson, 1946.
- Ena Harkness*: Crimson-scarlet, Norman, 1946.
- Charles Gregory*: Vermilion and gold, Verschuren, 1947.
- Spek's Yellow*: Bright yellow, Verschuren, 1948.
- Lady Belper*: Orange shaded bronze, Verschuren, 1948.

Note: Fourteen of the above varieties were raised by hybridists in the United Kingdom.

The Rose in Commercial Cultivation The raising of rose trees for sale has become one of the most important sections of the nursery trade. Every year several million trees are raised and distributed to customers at home and abroad. One firm in Essex

* It should not be inferred that the Hybrid Tea rose was entirely a creation of English rose breeders. Important advances were in fact made by French breeders, and breeders in Holland and Ireland also contributed.

THE ENGLISH ROSE

claims to grow a million trees annually. Export trade is now of considerable volume ; a Hertfordshire nursery has, for example, developed an export trade with fifty-five countries.

As a general rule, propagation is by the budding of seedling briar (*R. canina*) understocks, which are obtained in large quantities each season from Holland. The understocks, usually two sizes—3–5 mm. and 5–8 mm.—are planted during March on well-prepared and manured land. Usually the spacing given in the rows is 9 inches, with rows 3 feet apart to allow of motor cultivation ; such a spacing gives approximately 19,000 plants to the acre. The work of budding begins in July and continues if necessary through July and August. A "take" of buds around 75 per cent is considered average, but in favourable seasons up to 95 per cent may be obtained. As the understocks are budded on the main root, suckering is reduced to a minimum.

The understocks are "docked" at the outset of the second year ; the buds that have taken make growth in April so that a saleable rose bush has developed by October, when the lifting season begins. Including the time required to prepare the land, it thus requires a period of twenty-two months to raise a rose tree for sale ; by the time the land is cleared, the one crop has been on the land for twenty-four months. During the growth year the trees are carefully checked for bloom, any "sports" being removed. (Bud or somatic "sports" affecting flower colour occasionally occur in roses.) At lifting time the plants are carefully dug from the ground, examined, labelled and taken to the packing shed. There they are packed in various ways for dispatch by rail, sea and air, and also through the post. The packing of rose trees in straw is quite a craft and is the reason why the trees travel safely for long distances from the nursery. There is also a trade in "budding eyes," i.e., dormant buds, which are sent by air to various parts of the world during the period July to mid-October.

Although the number of varieties grown by nurserymen tends to vary, it is of interest to note that specialist growers are at present growing about two hundred varieties of Hybrid Teas, about sixty varieties of Polyanthas and about seventy varieties of Climbers, the three sections in which the trade is now mainly done. A varying number of species and hybrid forms of Briars, Musk roses, Moss roses, China roses, and Rugosa roses are grown also, but the trade in these is smaller.

The National Rose Society, established in 1876, is the official body representing the rose growers of Great Britain ; by 1952 its membership had reached a total of 32,500. An important step was taken by the Society in 1949, when arrangements were completed for the establishment of a trial ground at the Oaklands Farm Institute, Hertfordshire. The intention is that the trials shall be open to hybridists throughout the world, and that to safeguard the interests of the rose-growing public, only those varieties which prove their suitability under ordinary cultivation shall receive the Certificate of the Society. A total of 197 new varieties were entered for trial in 1952.

The Florist's Rose Roses for the cut flower trade are grown exclusively under glass. The rose is third in importance of the flower crops grown in glasshouses, the chrysanthemum and carnation taking precedence. Roses, however, resemble carnations in that they may be produced for sale almost throughout the year ; no other crop is therefore grown in the houses. Large span-roofed houses heated with hot-water or steam pipes are mainly used for growing them. The trees are planted out permanently in beds composed of suitably manured loamy soil about 24 inches



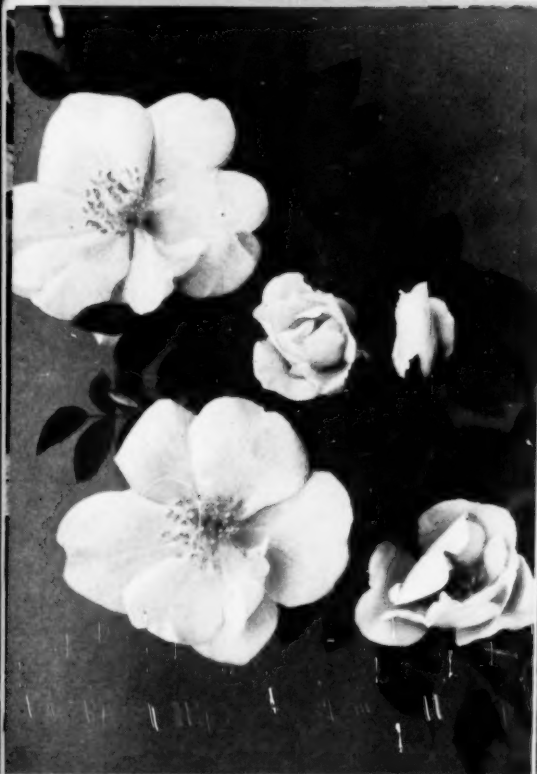
Loyal Greetings to Her Majesty Queen Elizabeth II





*Her Majesty receives the Freedom of the City
of London, June 1947*

Opposite : *Agricultural occasions*



The English

Hybrid Burnet Rose

Lady Belper

Prima Donna

Charles P. Kilham



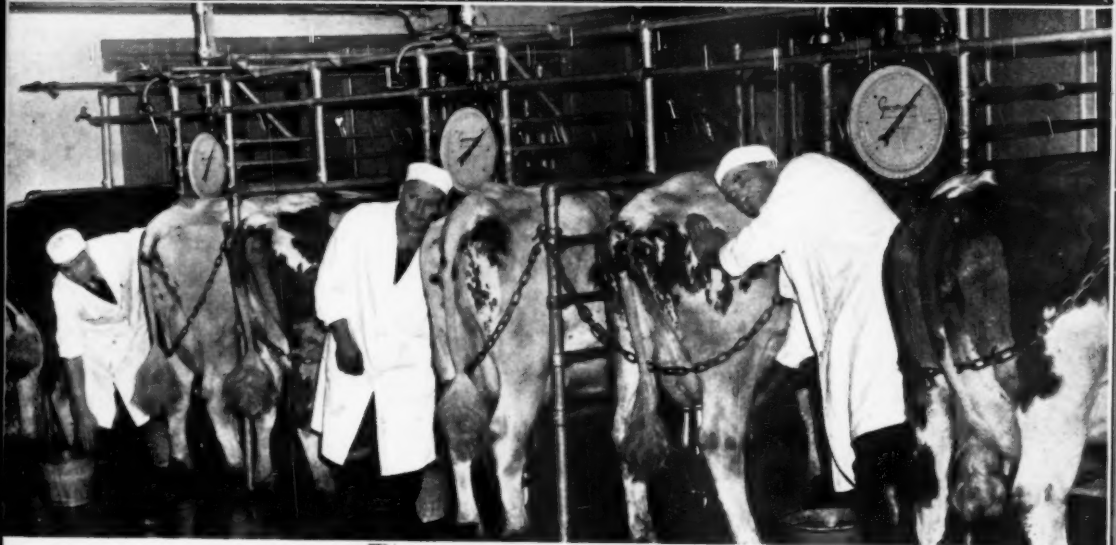
Rose (pp. 121-5)

Picture

Ena Harkness

Fantasia

Charles Gregory



Royal Farms,

Ayrshires at grass in winter.

Ayrshire milking parlour.

Table poultry are reared in fold units.

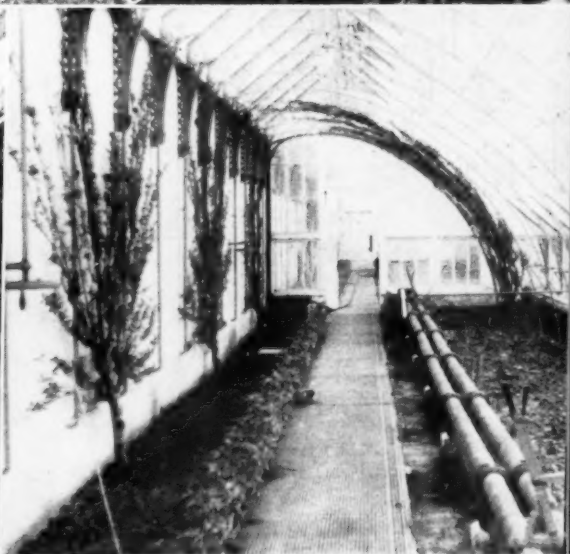


Windsor (pp. 101-5)

Dehorned Jerseys grazing kale.

Milking Jerseys by mobile machine
at the Prince Consort's Farm.

Laying flocks in a simply converted cattle yard.



Royal Gardens, Windsor (pp. 105—8)

Fruit, flowers and vegetables are grown intensively.

Under glass, orchids and peaches.

THE ENGLISH ROSE

in depth. The trees remain in the beds for upwards of ten years ; by particular methods of pruning and manuring, four or five crops of flowers are taken from the trees each year. As roses have to be specially grown to give the long stems required by the trade, each stem carrying a single bloom, a system of disbudding is practised. Before the war the estimated annual value of the rose as a commercial cut flower was approximately £300,000.

The Rose in History and Ceremony The rose took its place in English history at an early date. It appears to have been first used as a badge by Edward I (1272-1307) who may have inherited it, or obtained the idea, from his mother, Eleanor, Henry III's queen, known as the Rose of Provence. His brother, Edmund, the first Earl of Lancaster, also adopted a red rose as his badge (he was in Provins for a considerable time) and this became the Red Rose of Lancaster. By 1340 the Great Seal showed roses between the words of the inscription. A white rose was first used as a badge by Richard, a grandson of Edward III, taking it from Maud, his wife, whose family used it in memory of Fair Rosamund.* Probably this eventually became the White Rose of York, for we know that Richard's father, Edmund de Langley, also used a white rose as a badge after he became the first Duke of York in 1385.

The day came when the roses of York and Lancaster became emblems of the civil strife, the Wars of the Roses (1455-1485), which terminated after 30 years on the battlefield of Bosworth when Henry Tudor was acclaimed king. By his marriage with Elizabeth of York (1485), the king aimed at uniting the rival houses of York and Lancaster. The united roses, the design of the Tudor Rose, became the royal badge of the House of Tudor until James VI of Scotland joined the rose and the thistle for his badge as James I of England. But the Tudor Rose has retained a place among the royal badges until this day and the rose has become England's national emblem.

Today the rose graces many ceremonies both religious and civil. Amongst religious ceremonies none is so impressive as the annual Rose Service at St. Alban's Cathedral on the Saint's Day. Year after year the cathedral, formerly the Abbey Church, is crowded with people who come to take part in the annual pilgrimage. Bearing in their hands their gifts of red roses, the emblem of martyrs, and led by the Bishop of St. Albans, carrying his pastoral staff wreathed in red roses, the people reverently lay their floral gifts at the foot of the shrine of St. Alban, the first English martyr.

In the time of another Elizabeth, Robert Herrick in his *Parliament of Roses* "voted the Rose the Queen of Flowers". Today, when our young Queen Elizabeth II has just been crowned, what eulogies might he not have lavished on the modern improved varieties ? Herrick, not Milton, should be living at this hour !

On pp. iv and v of the art inset are illustrated the Burnet Rose (*R. spinosissima*) and seven Hybrid Tea roses.

* See *A Treatise of Heraldry*. JOHN WOODWARD, 1892.

SEAWEED AS A STOCKFOOD

W. A. P. BLACK, B.Sc., Ph.D., F.R.I.C.

Institute of Seaweed Research, Inveresk, Midlothian

The brown seaweed commonly found around the coasts of Britain is a rich source of carbohydrates, minerals, trace elements, vitamins and other growth-promoting substances, and, on the evidence of trials so far reported, it can provide a useful supplementary food for cattle, sheep, pigs and poultry.

ALTHOUGH sheep and cattle have grazed on our shores from time immemorial—in some cases existing almost entirely on seaweeds—and dehydrated seaweeds have long been used in many countries as a stock-food, comparatively little information has hitherto been available on the actual food value of seaweeds. This is due to the fact that very few controlled digestibility trials have been carried out and, where they have, the seaweed used has been mainly cast weed of doubtful origin, giving, in many cases, results of a contradictory nature.

In general, the seaweeds can be divided into four main groups: (1) the brown seaweeds; (2) the red seaweeds; (3) the green seaweeds; and (4) the blue-green seaweeds. But as only the brown seaweeds occur around the shores of Britain in sufficient quantity to make their collection an economic proposition, work has, up to the present been confined entirely to this variety.

Great Variation in Composition In carrying out digestibility trials with seaweed, one of the main difficulties is the great variation in composition. This, however, is also a marked feature of farm foods, especially grassland products. The changes are typical of all plants and, just as in the case of grasses where the composition is closely related to the ratio of leaf to stem, in seaweeds the composition depends on the ratio of frond (leaf) to stipe (stalk).

The brown seaweeds can be further divided into two main classes: (1) the littoral or rock weeds which occur between high and low water mark, with *Ascophyllum nodosum* (knotted wrack) the predominant species; and (2) the sublittoral weeds which grow below low water down to 12 fathoms (72 feet), with *Laminaria cloustoni* predominating. In brief, therefore, two main types of seaweed meal—"Ascophyllum meal" and "Laminaria meal" can be considered, although only the former is at present available commercially. A typical analysis of these two meals is given in the following table:

	Dry Matter	Crude Protein	True Protein	Ether Extract	Crude Fibre	Total Ash	Nitrogen -free Extractives	Calcium	Phosphorus	Calc. Starch Equivalent
<i>Ascophyllum</i> meal	95.10	8.38	6.31	3.12	2.99	20.86	59.75	1.16	0.114	19.2
<i>Laminaria</i> meal	96.04	7.27	5.80	1.67	3.88	26.73	56.49	2.36	0.226	49.4

Carbohydrates. In the absence of free sugars, seaweeds contain the hexahydric alcohol mannitol, which varies from 5 per cent to as much as 25 per cent of the dry matter. D-Mannitol, or manna sugar, is a colourless, odourless, crystalline powder with half the sweetness of sucrose. Small amounts of mannitol are readily utilized, being partly converted to glycogen, but in comparatively large doses it has a mild laxative effect. In

SEAWEED AS A STOCK FOOD

place of the starch of the land plants, a glucose polymer called "laminarin" is present in the brown seaweeds, and in autumn it makes up 25 per cent of the dry matter of the plant. It is easily split up by enzymes and weak acid to give an equal amount of the sugar glucose, and work at the Hannah Dairy Research Institute has shown that it is the only constituent readily utilized by the bacteria in the bovine rumen.

Seaweeds have a low crude fibre content (2-10 per cent), the place of cellulose in the cell wall structure being largely taken by alginic acid (15-25 per cent of the dry matter). Nelson and Lemon (1) have investigated this substance and have concluded that it has considerable nutritive value. The nutritive value of the other carbohydrates present has not yet been investigated.

Proteins. The proteins of seaweeds, in common with those of most other land plants, are less assimilable than animal proteins. Recent work has shown the presence of all the essential amino-acids, but the crude protein content rarely exceeds 15 per cent (5-15 per cent on the dry basis) and seaweeds cannot therefore be regarded as a source of proteins.

Fats. The brown seaweeds contain amounts of fats varying from less than 1 per cent to 8 or 9 per cent, and here also there seems to be very little difference between those present in seaweeds and those in land plants.

Minerals and Trace Elements. A characteristic feature of seaweeds is their high mineral content (up to 35 per cent of the dry matter), and it can be said that they contain all the elements which have so far been shown to play an important part in the physiological processes of the animal. In a well-balanced diet, therefore, seaweed would seem to be an excellent mineral supplement.

The occurrence of iodine is also a point of major importance. Depending on the species and season of the year, the brown seaweeds contain 0.03-1.5 per cent iodine (dry basis) in a form more valuable than in iodine salts, being partly present as the precursor of thyroxine.

Vitamins. Seaweeds can be considered a valuable source of vitamins. Although they do not contain vitamin A, they do possess its precursor, carotene, and fucoxanthin, a pigment which may also give rise to vitamin A. They also contain vitamins B₁ (thiamine) and B₂ (riboflavin), while recent work by Ericson (2) has shown the presence of vitamin B₁₂ in amounts comparable to those in liver. Vitamin C occurs in appreciable quantities and there is evidence of the presence of vitamins D and E. In addition to these vitamins, seaweeds contain other growth-promoting substances.

Early Digestibility Trials The earliest recorded trials took place in France (3) during the First World War, when the possibility of utilizing seaweed as a supplementary feed for poultry, pigs and horses was investigated. The animals accepted, digested and assimilated the seaweeds, but the interesting point was that the seaweed appeared to remain completely undigested for the first few days. After the sixth day no seaweed as such appeared in the faeces, and the digestibility was excellent.

More recent work in Norway (in 1939-40) emphasized the differences which can arise in the nutritive value of seaweed meals according to the species used and the time of year when it is collected. Lunde (4) conducted feeding trials with rats, pigs, horses and poultry, and showed that the addition of 5-10 per cent seaweed was very beneficial. Ringen (5) carried out similar trials with pigs and sheep and tested two proprietary meals, one made from the sublittoral weed and the other from the rock weed "knotted wrack".

SEAWEED AS A STOCKFOOD

The results showed that the nutritive value was exceedingly low, especially for pigs, but that ruminants could utilize it better. The value of the first meal was also considered higher than that of the second.

Other trials worthy of mention are those carried out in Eire. In 1943, Sheehy and co-workers (6) carried out digestibility trials with pigs, and showed that *Laminaria* meal had a feeding value for pigs about two and a half times that of potatoes and intermediate between hay and oats. In addition, by exerting a very favourable mechanical action on the alimentary tube of the animal, the seaweed meal enhanced the nutritive value of the original basic ration.

Experiments have also been carried out at the Albert Agricultural College in Eire (?) over a period of three years to determine the nutritive value of seaweed when fed to sheep (25 per cent of the total ration). The most satisfactory sample collected in the autumn was comparable in feeding value with meadow hay.

Work under the Auspices of the Institute of Seaweed Research In 1949, Tribe (then at the Rowett Research Institute) made a study of the habits of the North Ronaldshay 'sheep' (8), which live almost entirely on seaweed for the greater part of the year, and collected samples of the weeds which they selected. These samples were identified and analysed at the Institute. It would appear that the sheep chose the species with the highest ash, laminarin and iodine content and that there may be some correlation between palatability and nutritive value. On the other hand, the sheep seemed to select the new growth, the most succulent parts of the brown algae, and red weeds such as dulse.

In Ireland, seaweed is occasionally stored in pit silos or dried and stored interlayered with hay for winter feeding. Work in progress at the Institute has shown that seaweed supports a much more vigorous acid fermentation than grass and can be preserved by ensiling with very little change in chemical composition.

Digestibility trials (unpublished work) with pigs and sheep were carried out at the Rowett Research Institute in 1947. Four samples of dried, milled seaweed were used to form 20-24 per cent of the total ration, and the samples were purposely chosen to give a wide range in chemical composition. The results confirmed those of previous investigators in that the *Laminaria* meal was more digestible than *Ascophyllum* (knotted wrack), and that ruminants make better use of seaweed than do pigs. In general, *Ascophyllum* meal had not a high digestibility, the protein not being digested itself and even reducing the digestibility of the protein in the basic ration. With pigs, however, the October sample of the *Laminaria* meal had a high digestibility (88 per cent) for carbohydrates but a negative digestibility for protein, while the January sample had a 45 per cent digestibility for carbohydrates and a positive protein digestibility.

In 1952 a group comparison feeding trial with pigs was carried out at the Edinburgh and East of Scotland College of Agriculture, where two sets of 5 pigs drawn from two litters were paired off for equality in sex and body weight etc., and each pair randomized between two groups. Group feeding was practised. The control group received an all-meal mixture and the trial pigs a meal mixture containing seaweed meal. The seaweed meal (*Ascophyllum nodosum*—knotted wrack) replaced barley meal on a pound-for-pound basis; 5 per cent was introduced at the age of 10 weeks (average weight 50 lb.) and the quantity fed was increased gradually to 12 per cent, at which level it was fed up to bacon weight. The results were encouraging, and satisfactory

SEAWEED AS A STOCKFOOD

liveweight gains were recorded with pigs between 50 and 200 lb. live weight ; the resulting carcasses were of bacon quality and had no taint.

The feeding of seaweed meal to dairy cows has also been investigated at a number of farms in the west of Scotland⁽⁹⁾. In general, it would appear from the observations of the farmers that seaweed meal is rather unpalatable to cows, although at one or two of the farms the cows ate the seaweed meal with relish. Both *Laminaria* and *Ascophyllum* meals were fed at the rate of 8 oz. per day, and in all cases where the seaweed was accepted there was a positive response in the fat content of the milk. This is being investigated further.

It is well known that the non-protein nitrogenous constituents of feeding-stuffs may be of value in the rumen only if there is also an abundance of simple sugar or starch in the diet. Experiments have been carried out at the Hannah Dairy Research Institute to determine to what extent protein synthesis predominates in rumen contents when a variety of different substances, including seaweed and its constituents, are made available. The test, however, only determined the types of substances the rumen bacteria can utilize quickly while the bulk of the non-protein nitrogen is available. Laminarin was found to give as good a decrease in non-protein nitrogen as maltose, but was the only constituent of the brown algae readily utilized by the rumen bacteria.

Feeding Seaweed to Poultry Experiments have been carried out at Reading University to find the level at which seaweed can be fed to hens without upsetting the mineral metabolism. Three seaweed meals, two of *Laminaria* with high and low ash contents, and one of *Ascophyllum*, were tried. The birds used were Rhode Island Red hens approximately one year old and in full production. Summarizing the results, it can be said that the replacement of 10 per cent of the basal ration by an equal weight of any of the three seaweed meals had no ill-effect on the birds ; egg production was maintained and the birds remained perfectly healthy. Water consumption increased, and there was a marked increase in the chloride content of the droppings. It was found, however, that 20 per cent of seaweed meal, when fed in conjunction with a mineral supplement, upset the metabolism of the birds. These short-duration trials (16 days) were followed by a 200-day trial, also with one-year-old Rhode Island pullets. For the first 100 days, 10 per cent of their basal ration was replaced by a similar amount of seaweed meals, the amount being increased to 15 per cent for the second 100 days. The results confirmed those of the early metabolism experiments, i.e., that 10 per cent of seaweed meal could be fed without upsetting the metabolism of the birds.

Initial experiments with chickens have also been carried out at the Edinburgh and East of Scotland College of Agriculture. Seaweed meal (*Ascophyllum*) has been fed to day-old chicks as their sole source of vitamins A and D. The results were promising and larger-scale experiments are now in progress at a large poultry farm.

In all the poultry trials it was noted that the seaweed definitely increased the palatability of the rations but had little effect on the colour of the egg yolk.

Conclusion It would appear, therefore, from the evidence available that the ingestion of seaweed or seaweed products, besides providing carbohydrates and a valuable supply of minerals, trace elements, vitamins and other growth-promoting substances, exerts a most beneficial influence upon digestion in general, the gelatinous substances present in seaweed

SEAWEED AS A STOCKFOOD

providing excellent roughage, stimulating the movements of the intestines and facilitating elimination.

References

1. Metabolic Studies with Algin and Gelatin. H. W. NELSON and J. M. LEMON. *U.S. Fish and Wildlife Serv. Res. Dept.*, 1942, 4, 1-5.
2. Uptake of Radioactive Cobalt and Vitamin B₁₂ by Some Marine Algae. L. E. ERICSON. *Chem. & Ind.*, 1952, 829-30.
3. Note on the Use of Certain Seaweeds for Feeding Horses. M. ADRIAN. *Comp. rend. Acad. Sci. Paris*, 1918, 166, 54-6.
The Use of Seaweed Meal in the Feeding of Pigs. A. M. LEROY, *et al.*, *Ann. agron. Paris*, 1946, 16, 181-8.
The Use of the Marine Algae for the Feeding of Horses. L. LAPICQUE. *Comp. rend. Acad. Sci. Paris*, 1918, 167, 1082-5.
The Marine Algae and their Utilisation in the Ration. L. LAPICQUE. *Bull. off. Dir. res. sci. indr. inventions*, 1920, 500-8, 682-703.
4. Feedstuffs from Seaweeds. G. LUNDE. *Papir J.*, 1940, 28, 147-52.
5. The Nutritive Value of Seaweed. J. RINGEN, *Meld. Norg. Landbruk*, 1939, 19, 451-541.
6. Seaweed (laminaria) as Stock Food. J. E. SHEEHY, J. BROPHY, T. DILLON and O'MUINEACHIAN. *Econ. Proc. R. Dublin Soc.*, 1942, 3, 150-61.
7. The Feeding Value of Seaweeds. B. J. SENIOR, P. COLLINS and M. KELLY. *Econ. Proc. R. Dublin Soc.*, 1946, 3, 273-91.
8. Sheep Grazing of Seaweed. Observations on North Ronaldshay, Orkney Is. D. E. TRIBE and E. M. TRIBE. *Agriculture*, 1949, 36, 416-9.
9. Feeding of Seaweed Meal to Lactating Cows. G. DUNLOP. *Nature*, 1953, 171, 439.

AGRICULTURAL INDEX NUMBERS AND PRICES MONTHLY INDEX NUMBERS AND PRICES OF AGRICULTURAL PRODUCTS INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION) BASE 1927-29=100

	Unit	Prices used for March 1953 Index	1953			1952		
			Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
All Products ..	—	—	312*	303*	288*	307	293	278
Cereals and Farm Crops ..	—	—	263	270	277	281	278	278
Livestock and L'stock Products	—	—	326*	313*	291*	315	298	278
Wheat ..	cwt.	s. d. 31 8	298	300	306	285	285	289
Barley ..	"	31 2	280	287	283	394	363	328
Oats ..	"	26 3	284	288	284	319	307	308
Potatoes ..	ton	261 6	235	245	260	225	235	248
Hay ..	—	—	205	208	205	244	246	236
Fat cattle ..	Live cwt.	138 3	260	272	281	244	255	261
Fat cows ..	"	73 7	194	206	209	199	210	215
Fat sheep ..	lb. d.w.	2 10½	245	259	269	233	269	269
Fat ewes ..	"	1 10	224	242	267	218	258	270
Bacon pigs ..	Score	55 5*	362	362	363*	348	349	350
Pork pigs ..	(20 lb.)	50 6	299	299	299	298	298	298
Sows ..	d.w.	27 5	238	238	238	238	238	238
Milk ..	Gallon	3 5.5*	369*	348*	319*	359	337	309
Butter ..	12 lb.	36 0	171	171	171	143	143	143
Poultry ..	—	—	266	264	248	293	279	272
Eggs ..	120	41 10	317	283	230	293	235	197
Store Stock†		£ s. d.						
Dairy cows ..	Head	55 13 0	217	214	206	207	206	197
Store cattle ..	"	40 14 0	257	268	280	216	229	242
Store sheep ..	"	7 10 9	256	272	278	244	263	275
Store pigs ..	"	9 1 9	475	481	483	378	388	400

* Provisional

† Not included in general index

RESEARCH AT LONG ASHTON

PROFESSOR T. WALLACE, C.B.E., F.R.S.

Director

Long Ashton Research Station

This year marks the jubilee of Long Ashton Research Station, the second oldest research station in the country. The following account by the Director gives some idea of the varied and important research being carried out there.

THE Long Ashton Research Station was established as the National Fruit and Cider Institute in 1903 for the purpose of carrying out experiments in cider-making. It extended its activities to include fruit culture in 1912, when the Institute became associated with the University of Bristol to become a National Research Station under the scheme of the Board of Agriculture for the development of agricultural research in England and Wales. Of the agricultural research institutes in Great Britain, Long Ashton is second in point of age to Rothamsted.

The official jubilee celebrations of the Station will take place on July 22 and 23. The main features of these celebrations will be a special lecture on Agricultural Research by Lord Rothschild, G.M., Sc.D., F.R.S., Chairman of the Agricultural Research Council, to be delivered in the University on the afternoon of July 22, and a Field Day at Long Ashton on July 23, at which the Minister of Agriculture will give an address.

The Station is also publishing a jubilee volume entitled *Science and Fruit**—a volume intended to serve as an historical record of the Station's activities over the fifty-year period. It will include a detailed account of the foundation of the National Fruit and Cider Institute, and the development of the Station up to the present day. This will be supported by twenty-one articles dealing with the developments and achievements of the Station in its main subjects of research and with current investigations. The jubilee lecture will also be included. The foreword to the volume has been contributed by the Chancellor of the University, Sir Winston Churchill.

Some of the subjects of present-day research at the Station discussed in the volume are :

CIDER AND FRUIT JUICES. Factors affecting the quality of cider ; disorders of cider.

FRUIT CULTURE. Plant hormones ; blackcurrant culture ; fruit breeding.

PLANT NUTRITION. Sand culture methods ; mineral nutrition of fungi ; use of chromatographic methods in plant nutrition studies.

PLANT PATHOLOGY. Apple and Pear Scab ; important fruit pests ; chemical standardization of insecticides and fungicides ; insecticidal activity of DDT ; spraying machinery.

METHODS OF DOMESTIC FOOD PRESERVATION. Scientific aspects of the domestic preservation of fruit and vegetables.

The subjects comprising the present research programme, with the exception of cider, have gradually evolved since 1918 when the first substantial expansion of the work took place following the inauguration of the Board of Agriculture's scheme of 1912, the development of which was temporarily halted by the 1914-18 war. Between the two world wars, the Station also

Note : A brief account of the history of the Long Ashton Research Station, with some reference to its main lines of research, was given in the July 1949 issue of *Agriculture* (56, 170).

* Obtainable direct from Long Ashton, price 30s.

RESEARCH AT LONG ASHTON

served as part of the Bristol Provincial Advisory Centre, dealing in particular with problems of horticultural crops. These activities were relinquished on the establishment of the N.A.A.S. in 1946. The period 1939-45 also witnessed the intensification and extension of plant nutrition investigations, which led to the establishment at the Station on April 1, 1952, of the Agricultural Research Council's Unit of Plant Nutrition (Micro-nutrients).

For 1953 the programme of research is grouped under the following headings : *Nutrition of Fruit Trees* ; *Pomology*, including commercial and cider fruit growing and fruit breeding ; *Pests and Diseases and their Control*, including the chemistry of insecticides and fungicides, entomology and plant pathology ; *Cider and Fruit Juices* ; *Domestic Food Preservation*, including preservation of fruit, vegetables, meat and poultry ; *Willow Culture*. The A.R.C.'s Unit of Plant Nutrition (Micro-nutrients) is investigating the nutrition of crops and micro-organisms, with special reference to the effects of micro-nutrient elements.

Nutrition of Fruit Trees Previous work at Long Ashton has shown the importance of the various mineral nutrients in the nutrition of fruit crops in England and, in particular, has established the nature and importance of the effects of deficiencies of nitrogen, potassium, magnesium, iron, manganese, copper and zinc. It has also demonstrated the lack of effects of phosphorus deficiency in orchards. The main practical problems of supplying mineral nutrients to deficient crops have also been determined, and suitable methods have been evolved for applying nutrients as fertilizers through injections and foliage sprays. Some effects of cultural practices on the mineral status of tree fruits and on fruit quality have also been examined and, in particular, the significant effects of grass culture on the status of nitrogen, phosphorus, potassium and iron have been shown.

The present programme follows naturally from these earlier results and concerns the following points : the effects of cover crop systems on the mineral status of tree fruits and on soil fertility, and the interaction of fertilizers and cultural systems ; methods of nutrient placement, particularly methods of placing fertilizers in the soil and the use of foliage sprays ; the relationship of nutrient status to crop yields.

In the cover crop work the effects of individual grasses and legumes in mobilizing mineral nutrients from soils, and also their effects on soil structure, are being examined both in special plots without trees and under orchard conditions. These points, it is considered, are fundamental to the proper use of cover crops for tree fruits, and in this connection, it should not be accepted without critical trials that legumes are superior to grasses for this purpose. Results have shown that grass covers, cut and left *in situ*, may improve considerably the status of fruit trees for potassium, phosphorus and iron (although depleting the level of nitrogen) and that the mineral composition of grasses more nearly resembles that of fruit trees than does that of legumes. Problems of "feeding power" for nutrients and effects on soil structure are also involved and, in these respects, grasses may also prove superior to legumes.

The placement of nutrients is very important for many fruit crops, especially of magnesium and trace elements (except perhaps boron) and our experiments aim, in particular, at examining soil placement methods and foliage sprays. The use of urea as a foliage spray is under investigation, and in soil studies the effects of soil conditioners, such as krilium, on structure and nutrient supply, are being ascertained. The relationships of nutrient

RESEARCH AT LONG ASHTON

status to crop yields are difficult to determine for fruit crops because of the interfering effects of pruning treatments, but good progress has been made in studying nitrogen relationships in the black currant.

Pomology Much attention has been given during recent years to problems of growth substances in relation to fruit-drop, fruit thinning, parthenocarpy and fruit maturity of apples and pears, and in relation to the dormancy of apple seeds and to bud-break of various fruits. In addition to the purely practical aspects of this work, more fundamental studies have been made, such as the application of chromatographic methods to the identification of auxins and inhibitors in plant organs and tissues, and the development of methods for the assay of growth substances in fruit plants. Many synthetic compounds have also been examined for growth-promoting properties by a number of tests now in routine operation at Long Ashton.

In rootstock investigations, the possibility of using apomictic seedlings of *Malus* species is being examined. Should these prove suitable, they might provide an alternative to layered rootstocks, and be especially useful for scion varieties, such as *Lord Lambourne*, that are affected by virus diseases that may be transmitted by the commonly used vegetative rootstocks.

Parallel with this work, search is being made for latent viruses among the rootstocks used for the different tree fruits.

Many problems of cider orcharding are being investigated. Trials are in progress of stem builders for standard trees, and several trial orchards of cider trees in bush form have been established to test this method of growing cider fruit. Records to date show that the bush trees crop much earlier than do the standards, and heavy yields of fruit have been obtained from a very early stage.

Other aspects of the work of this section include flowering dates of cider varieties, their pollination requirements, their identification by vegetative characters, and their general suitability as orchard trees and for vintage purposes. Recently, there has also been a renewed interest in perry pears, and this is leading to studies similar to those in progress on cider fruit.

In fruit breeding, work is in progress on the production of cider varieties, dessert apples and pears, and on plums. In the case of cider there is a need for varieties with the vintage qualities of *Kingston Black*, combined with good orcharding characters, and for varieties to extend the cider-maker's milling season. With dessert apples and pears, the emphasis is on the production of good early and late varieties, and with plums, on good dessert quality. For black currants, the objective is the production of a succession of heavy cropping varieties with high ascorbic acid content.

Chemistry of Insecticides and Fungicides An outstanding feature in the control of pests and diseases since 1940 has been the introduction, in large numbers, of new and novel insecticides and fungicides, of which, among the insecticides, DDT, BHC and the systemic phosphorus compounds may be mentioned. These have raised many difficult scientific problems regarding their mode of action and the relationship of their toxic properties to chemical structure. Long Ashton workers have been engaged on these problems, especially with DDT and related compounds. The introduction of these insecticides has also raised some analytical problems, several of which have been investigated for specification purposes and in connection with problems of spray residues. Problems of systemic insecticides have prompted the use of radio-active methods, using P^{32} ,

RESEARCH AT LONG ASHTON

and these methods will be developed considerably in the near future. Arising from the work on systemic insecticides and the preparation of synthetic growth substances, investigations with the object of finding systemic fungicides have been undertaken, but although a certain amount of progress has been made with these, their possibilities are not so clearly evident as for insecticides.

The development of the newer potent insecticides, some of which present human hazards in their use, has led to the investigation of possible toxic spray residues on plants, and to the re-examination of the older and safer insecticides, such as derris and pyrethrum, with a view to improving their field performance. Another aspect of the chemical work is the examination of the physical properties of dusts and sprays to increase their adherence.

Entomology As a result of experience gained prior to 1940 in the control of difficult pests, such as Apple sawfly and Red Spider mite, and the practical difficulties encountered in applying orchard sprays, the entomologists have given considerable attention to the mechanical problems of spray applications. This led in the first place to the design and construction of different types of spraying machines and equipment to ensure improved application and wetting properties of spray fluids. The initial work has been followed by attempts to produce efficient automatic spraying units, including low-volume machines, and this in turn has led to an examination of orchard layout in relation to spraying techniques. These more practical aspects of the work have shown the need for research work on the physical and chemical properties of sprays as applied in the field, and laboratory-scale experiments are now in progress to provide a basis for the work.

Parallel with these investigations, intensive laboratory bio-assays are in progress to determine the mode of action of various insecticides on special test insects.

The use of modern insecticides has also raised difficult questions of their effects on the natural relationships between pests and their predators, and these problems are being examined in studies of insect populations as affected by spray programmes.

Finally, in the field of systemic insecticides, detailed studies are in progress to follow their course and action within plants, and the changes that they may undergo in plant tissues.

Plant Pathology The diseases of Apple and Pear Scab, Apple Canker and Brown Rot of apples and plums have been the subject of intensive investigation at Long Ashton for many years, and they continue to be so. Whilst field trials continue with the object of finding improved methods of control, more fundamental studies are in progress, both in the laboratory and the field, to study life histories, mode of infection and host-parasite relationships. This last aspect of the work forms part of a broader study of this subject in which the above-mentioned fungi are used as test organisms.

During recent years there has been an intensification of more fundamental studies on a laboratory scale, involving experiments under highly standardized conditions of environment. These include the biology of pathogenic fungi, involving surveys of enzymes produced by the fungi and the principles of fungitoxicity, in which the antidoting of fungus enzymes by fungicides and the effects of these on the respiration of fungi are studied. The section has also undertaken the task of testing, by laboratory methods and in the

RESEARCH AT LONG ASHTON

field, large numbers of fungicides that have been placed on the market, particularly as substitutes for lime sulphur, and the newer concentrated sprays. In both cases, tests are needed to determine fungicidal and phytotoxic properties.

In collaboration with the Pomology section, virus diseases of tree fruits have formed the subject of continuous investigation since the war, particularly those affecting the apple variety *Lord Lambourne*, plums and sweet cherries. Two results of note arising from this work have been the discovery of the Rubbery Wood virus in apple rootstocks and a disease of plums which has been named "Plum Stunt".

The work already referred to on systemic fungicides may open up new avenues of attack on the problems of the toxic effects of fungi and the mode of action of fungicides on the fungus and the host plant.

Cider and Fruit Juices The programme of research on cider continues to cover aspects of the whole field of operations concerned in cider-making, starting with the harvesting and storage of the fruit prior to the extraction of the juice, and ending with the storage and marketing of the final product. Research still emphasizes the importance of the raw materials—the intrinsic vintage qualities of the individual varieties—in determining the character of the product, but quality may also be affected by processing operations and storage conditions, which may produce undesirable chemical changes, largely caused by micro-organisms. Intensive studies embracing both chemical and micro-biological aspects are in progress to follow in detail the changes that occur in the unfermented juice prior to fermentation, and in the fermenting juice and the resulting cider. In the unfermented juice, the investigations concern the effects of treatments such as filtration, centrifuging, and the use of antioxidants and enzyme action; during fermentation the changes in yeast population are being followed by biological and biochemical tests, and chemical changes in nitrogen and phosphorus compounds and organic acids by micro-chemical techniques and chromatography; special attention has been given to the action of bacteria causing spoilage during storage, and detailed studies of the life histories and effects of the organisms are in progress.

Similar investigations have been made recently on perry manufacture, which presents problems differing in some respects from those of cider.

In fruit juices, the work concerns apple juice and blackcurrant products, the object in the former being to produce a pleasant beverage which will remain clear and free from deposit when bottled, and in the latter to obtain stable products with high ascorbic acid content. Apple juice, in particular, presents many difficult problems of stability which are being investigated from the viewpoints of enzyme activity and the action of micro-organisms. Problems of acidity are also being studied.

Domestic Food Preservation and Willow Culture The object of the work of the Domestic Food Preservation section is to provide recipes which the housewife can use under domestic

conditions. The basic problems concern changes that may occur in preserved products due to micro-organisms and enzymes where processing has been faulty. The main methods applied are sterilizing by heat or by preservatives, such as sulphur dioxide, and freezing. It is important that the methods adopted should have little deleterious effect on the original food values of the fresh materials, and, in particular, on the contents of vitamins of the B group and ascorbic acid, for which routine assays are made.

RESEARCH AT LONG ASHTON

Meat and poultry have recently been added to the original subjects of fruit and vegetables. They had not been included previously because of the risks attaching to faulty preservation methods, but it is now felt that they should be taken into consideration since, in any case, they are already widely preserved in the home.

The methods recommended as the result of tests are publicized through annual courses held at the Station for teachers of domestic science and officials of local authorities, by lectures, and by bulletins published by the Ministry of Agriculture.

Work on willow culture has only recently been resumed following a break since 1940. For the next few years work will be concerned chiefly with the classification of basket willows and practical methods of controlling pests and diseases in osier beds.

Unit of Plant Nutrition During the war the staff of the Plant Nutrition (Micro-nutrients) Unit was employed on the investigation of special problems arising from war-time cropping programmes, such as the ploughing of old grassland areas for arable cropping. These problems concerned mainly trace element deficiencies and special problems of soil acidity and liming. Special features of the work were the production of mineral deficiency and excess effects in crop plants in sand culture as a basis for visual diagnosis methods, the development of quick chemical tissue tests and the making of speedy field surveys of crop failures for nutrient deficiencies.

After the war the first two subjects were continued with special reference to trace elements, and the quick tests were supplemented by other tests based on the use of *Aspergillus niger* as a test organism for micro-nutrient elements. The surveys were replaced by field studies of soil acidity effects and molybdenum deficiency. In addition, a new section was added for the study of the organic constituents of crop plants and the effects of mineral nutrient status on these compounds.

Considerable progress has been made in all these sections. Arising from the pot cultures, two books have been published—one a colour atlas depicting the effects of nutrient deficiencies and excesses on crop plants (¹), and the other giving an historical account of sand- and water-culture techniques, and describing the sand-culture methods developed at Long Ashton(²). In addition, notable results have emerged in studies relating to iron and molybdenum deficiencies.

The investigations on *Aspergillus* have been extended to other fungi and bacteria and will have many applications in the Cider and Plant Pathology sections.

The work on organic constituents has been developed considerably by the use of chromatographic methods, and already substantial progress has been made in studies relating to amino-acids, phenolic compounds and organic acids. Changes in the amino-acid status of plants resulting from deficiencies of manganese and molybdenum have been shown.

The field work in its latest stages has enabled specific effects of soil acidity to be determined, particularly with reference to deficiencies of calcium, potassium, magnesium, phosphorus and molybdenum, and excesses of manganese and aluminium. In special studies of molybdenum deficiency and its control in the field, striking effects have been produced on brassica crops (especially cauliflower) and lettuce.

RESEARCH AT LONG ASHTON

In 1952 the work was further extended to study the behaviour of crops on soils giving rise to "swayback" in lambs and hypocuprosis in cattle, both of which are regarded as "conditioned" copper deficiencies.

References

1. T. WALLACE. *The Diagnosis of Mineral Deficiencies in Plants by Visual Symptoms—A Colour Atlas and Guide*. H.M. Stationery Office. 1st Edition, 1943 ; 2nd Edition, 1951.
2. E. J. HEWITT. *Sand and Water Culture Methods Used in the Study of Plant Nutrition*. Tech. Comm. No. 22. Commonwealth Bureau of Horticulture and Plant Crops, East Malling Commonwealth Agricultural Bureaux.

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the March 1953 issue of AGRICULTURE (p. 590), the undermentioned publications have been issued.

MAJOR PUBLICATIONS Copies are obtainable, at the prices quoted, from the Sale Offices of H.M. Stationery Office or through any bookseller.

Co-operative Farms and Smallholdings. Centralized Services in Wales, with Reports and Accounts of the Welsh L.S.S. 1950-51 (*New*) 2s. (2s. 1½d. by post).

LEAFLETS Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), 36 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from a Sale Office of H.M. Stationery Office.

Copies of Fixed Equipment on the Farm Leaflets are available under the same conditions as for Major Publications (see above).

Advisory Leaflets

- No. 245 Apple and Pear Scab (*Revised*)
- No. 306 Foul Brood (*Revised*)
- No. 318 The Mole (*Revised*)
- No. 392 Lettuce Aphids (*New*)
- No. 403 Fodder Beet : Feeding Value and Practice (*New*)
- No. 409 Stem and Bulb Eelworm on Clover (*New*)

Fixed Equipment of the Farm Leaflets

- No. 2 Financing Improvements to Land and Buildings (*Revised*) 4d. (5½d. by post).

FREE ISSUES Obtainable only from the Ministry (Publications), 36 Chester Terrace, Regent's Park, London, N.W.1.

Growmore Leaflets

- No. 57 Tomato Growing in Gardens and Allotments (*Revised*) (Formerly D.V.8)

Booklets and Leaflets

- At the Farmers' Service, 1953 (*New*)
- Code of Clean Milk Practice (*New*)
- Grants for Farm Drainage (*Revised*)
- Grants for Farm Water Supply Schemes : Welsh Version (*New*)

COLORADO BEETLE IN ENGLAND, 1952

I. THOMAS, M.Sc., PH.D. and I. R. HARRISON, B.Sc.

Ministry of Agriculture, Plant Pathology Laboratory, Harpenden, Herts

Although the number of single Colorado beetles reported in 1952 was more than in the previous year, there were only two breeding colonies, as compared with eight in 1951.

ONE hundred and twelve single Colorado beetles were found and reported in 1952, but only two breeding colonies were found as compared with eight in 1951. As in previous years, the arrival of Colorado beetles from the mainland of the Continent was in two distinct phases. The early beetles up to the second week in April were entirely associated with imports of vegetable produce (Fig. 1), a large proportion of these beetles being found in, or associated with, lettuce. The beetles found subsequently were mainly on ships docking in this country after visiting Continental ports (Fig. 2).

The first beetle reported was found on January 22 in a lettuce imported from the Perpignan area of France. Two more beetles were reported the following day on French lettuce, and on January 25 a single beetle was found on tangerines which had been stored with French lettuce and Italian cauliflower. During February two beetles were found, one on lettuce from Spain, and the other on lettuce from Spain or France. March and April again proved to be the main months for beetles on imported produce. Twenty-three were found during March, and twenty-nine in the first eleven days of April, despite the fact that the import of vegetables likely to harbour Colorado beetles is restricted after the end of March by the Importation of

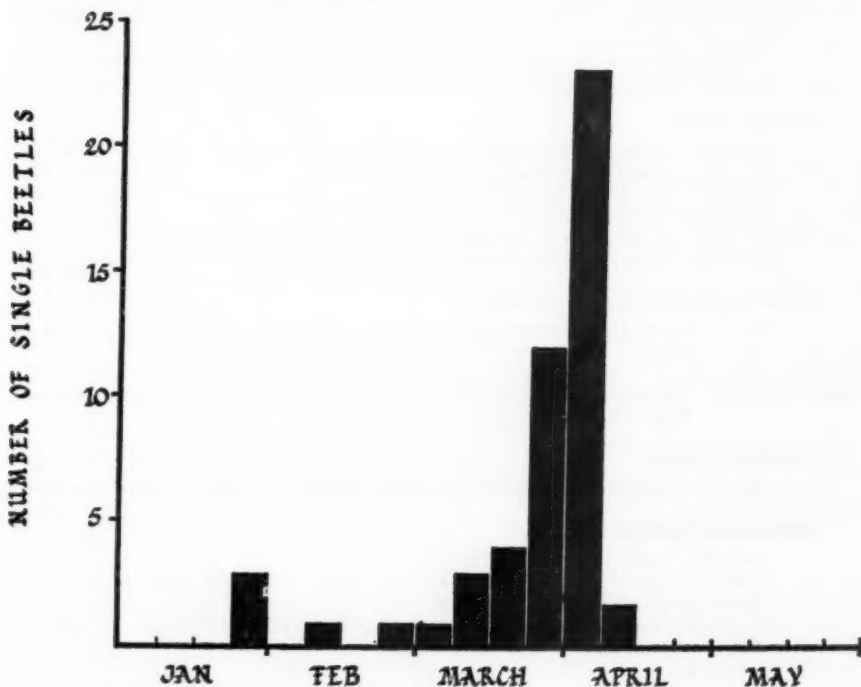


Fig. 1. Colorado beetles found on Imported lettuce (Imports restricted after the end of March)

COLORADO BEETLE IN ENGLAND, 1952

Plants Order. However, some of the beetles which arrived with lettuce in March were not found until they had been in the country for some days, and this accounts for most of the beetles found during the first few days of April. There was then a sudden decline in numbers and no more beetles were found during the remainder of the month.

Only eleven beetles were found in May and June, five of which were on ships. In July eighteen beetles were reported, and fourteen of these were on ships carrying various cargoes from France, Spain and Portugal. Four beetles were reported in August, one being found in a shed at an aerodrome. Nineteen beetles were found between September 19 and 25 at a parachute factory at Letchworth among parachutes which had been dropped by the Territorial Army in Germany on August 24. The batch concerned had fallen in a potato field, and the beetles were discovered when the parachutes were being cleaned after they had been returned for drying and repacking. Finally, during December two beetles were found on imported lettuce: the first, on December 13, was traced to the Perpignan area of France; the second, found on December 24, was of either French or Italian origin.

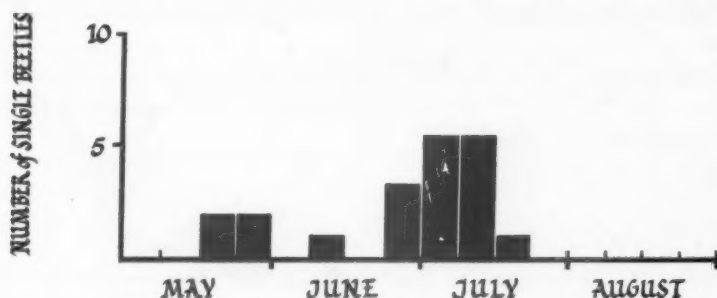


Fig. 2. Colorado beetles found on ships

Three dead beetles were reported in Scotland. The first was found on October 15 in the hold of a ship after a cargo of wheat from Rouen had been unloaded. The remaining two were found during November in camomile flowers imported from the Continent.

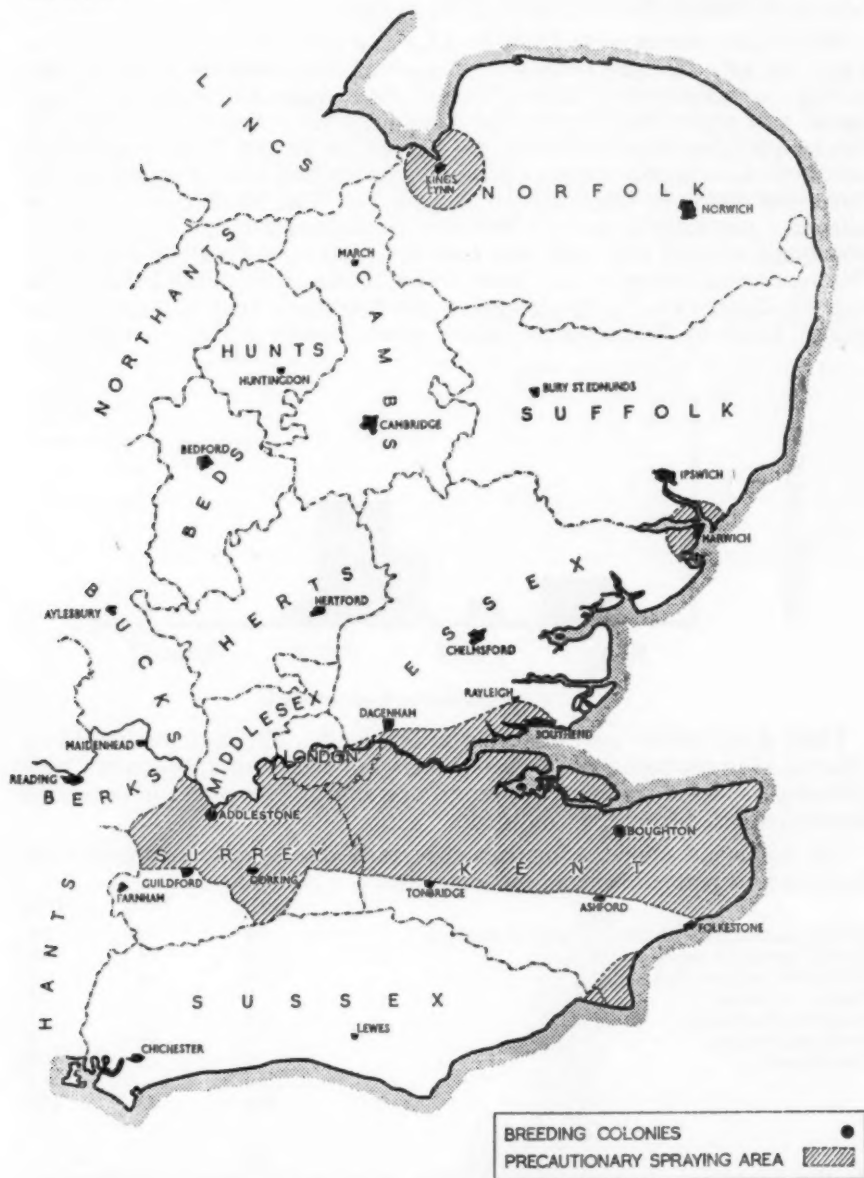
The following table summarizes the year's discoveries: figures for the two previous years are given for comparison.

	1952	1951	1950
Beetles associated with or on imported produce	64	41	54
Beetles found on ships	19	17	49
Docksides and beaches	1	5	11
Inland on potatoes	0	0	12
Inland miscellaneous	27	8	33
Odd dead beetles	0	10	8
On aircraft	1	2	3
	<hr/> 112	<hr/> 83	<hr/> 170

Beetles Breeding Two breeding colonies were found in south-east England, one in Kent and one in Surrey—both within the area which had been scheduled for subsequent spraying. The colony in Kent was reported on May 19 from a group of allotments at Boughton-under-Blean, near Faversham. On nine allotments, thirty-five beetles and over two thousand eggs were found. All the potatoes were heavily dusted with 5 per cent DDT, and the spraying team nearest to the area moved in immediately and

COLORADO BEETLE IN ENGLAND, 1952

sprayed the potato crops on the farms adjoining the allotments. The evidence suggests that an undiscovered colony probably occurred on one of the allotments in 1951, and that the adult beetles found had overwintered in the soil.



The second colony was found on June 21 in a private garden at Addlestone, Surrey. After a thorough search, one adult female beetle, approximately one hundred young larvae and several egg masses were found on seven rows of early potatoes. The infested plot, together with the potatoes in adjacent gardens, was then thoroughly dusted with DDT, and in subsequent visits no further larvae or eggs were found.

COLORADO BEETLE IN ENGLAND, 1952

Planned Spraying and Dusting A large area of potatoes is sprayed each year as a precautionary measure and the extent of this campaign is varied each season in the light of experience gained in previous years. The main areas sprayed this year were in north Kent, Romney Marsh, Surrey and Essex north of the Thames Estuary and around Harwich (see map on p. 140). Potato crops around the eight 1951 breeding places were sprayed as a routine measure.

As usual, the potato fields to be sprayed were mapped well in advance and the spraying campaign was chiefly the responsibility of Plant Protection Ltd. using ground spraying and dusting machines. Dusting was confined to one area in Essex. In addition, Pest Control Ltd. sprayed 872 acres around King's Lynn by helicopter. This latter spraying was done between July 10 and 15 in less favourable weather than in 1951, high winds causing operations to be spread out over a longer period. The exceptionally fine weather during June and July and the smaller acreage that had to be sprayed compared with the previous year enabled the main spraying campaign to be completed by the first week of August. Foot-and-mouth disease restrictions could have led to some alterations in the spraying programme but, fortunately, with the exception of one small area in east Kent, the campaign was not delayed.

A total of 3,643 fields were treated, representing 22,134 acres sprayed and 946 acres dusted. These were classified as follows :

Acres	No. of Fields	Percentage of Total
Under 2	769	21.11
2-5.9	1,386	38.04
6-10	841	23.09
Over 10	647	17.76

The DDT spray used was a 25 per cent miscible liquid, which resulted in fewer blocked jets than in previous years when an emulsion was used.

Legislation and the Beetle Although spraying and other direct measures are indispensable in the Colorado beetle campaign, it is important to remember that legislative measures help very considerably in preventing large numbers of beetles getting into this country from abroad. The vast majority of beetles that arrive with imported produce get here before the Importation of Plants Order comes into force in March ; of all the produce, lettuces appear to harbour far more beetles than any other. This particular aspect of the problem, and the more general one of the Colorado beetle position in England in relation to its spread on the Continent, has been discussed in detail in the December 1952 issue of *Plant Pathology*.* There, it is shown that the Continent is the source of nearly all the single beetles found in Britain, and it is concluded that if the campaign against the Colorado beetle in this country is uniformly efficient over a period of years, then the number of colonies discovered will continue to reflect the position in Europe. It is also shown that as the beetle advances south on the Continent so it emerges from hibernation earlier and earlier in the season, and future legislation may have to take this into account. A beetle arriving in this country during the summer when temperatures are high and potato crops abundant probably stands a much better chance of survival than one arriving in midwinter. On the other hand, even the winter arrivals may be of some importance, because if the

* Colorado Beetle in England in Relation to its Spread on the Continent. I. THOMAS, *Plant Pathology*, 1952, 1, 103-8.

COLORADO BEETLE IN ENGLAND, 1952

ground is not frozen hard they can readily bore into the soil and hibernate, to emerge again when conditions are suitable. In some years, conditions will be more suitable than in others, and in 1952 it would seem that very few, perhaps none, of the early arrivals survived the vicissitudes of climate and succeeded in establishing colonies on potatoes.

Beetles arriving late in the autumn could also survive by hibernating in this country throughout the winter and thus become a source of danger. But it is obvious that short of stopping all traffic with the Continent, we cannot prevent beetles from arriving in Britain. Our answer must therefore continue to be to prevent the importation of produce most likely to harbour beetles, and be ready to deal promptly and efficiently with beetles that succeed in crossing the Channel, or indeed the occasional one that succeeds in crossing the Atlantic.

Once again, thanks are due to the public for their interest and co-operation in the Colorado beetle campaign, and especially to the growers and farmers who have been most directly concerned. As in previous years, the help given by the police has been invaluable in tracing the origin of many of the single beetles imported from the Continent. Thanks are due also to the captains and crews of cross-Channel steamers for their constant vigilance and prompt reporting of beetles.

Much credit is due to the whole-hearted co-operation of the staff of Plant Protection Ltd. who, as in previous years, were responsible for organizing the main spraying campaign, and to Pest Control Ltd., who were responsible for the successful spraying of potatoes by helicopter in the King's Lynn area.

It cannot be over-emphasized that much of the success of the campaign is due to the prompt reporting of beetles to the police, to officers of the National Agricultural Advisory Service or direct to the Ministry's Plant Pathology Laboratory, Milton Road, Harpenden, Herts. If a colony of grubs or beetles is found and reported, nothing more should be done until the arrival of an officer of the Ministry.

FARMING AFFAIRS

The Bath and West at Bath The Bath and West Show, back on its home ground this year (the first time since 1927), recalls the name of Edmund Rack, that retired business man and Quaker, who came from Norfolk to establish the Bath Society in 1777. As the first minutes record, the Society had as its aim "the encouragement and improvement of agriculture, manufactures, commerce and the fine arts in Somerset, Wilts, Gloucester and Dorset". It was not until 1868 that the Bath Society amalgamated with the Southern Counties Agricultural Association to form the present Society, the fame of which is now world-wide.

Farming in the West of England in the late eighteenth century was still little removed from the primitive; implements were few and simple, crop yields were small, roots unknown, and livestock poor and unthrifty. Almost immediately the leading members of the newly-formed Society established what was tantamount, in modern parlance, to an experimental farm.

Visiting Bath, this year it is salutary to remember the humble beginnings of the Society; its first show held in a backyard in Bath, its first open show, held at Taunton in 1852, when stock entries totalled only 238.

FARMING AFFAIRS

The four-day show at Claverton Down, Bath, this year covers over 90 acres. Each inch of available space has been utilized. The Trade Section is the largest since the war, with over 400 stands. All the leading manufacturers are exhibiting. Because the Show is being held during the week of the Coronation, it was not anticipated that the stock entries would be very large, but they have in fact exceeded all expectations. The entries in each section, with the exception of sheep, are comparable to the very fine show of stock at Dorchester in 1951; the cattle entries exceed the Dorchester figures. His Royal Highness the Duke of Cornwall is exhibiting in his own name for the first time at any Show.

The entries in the Flower Show have been so great that the marquee has had to be extended by 40 feet, making a total area of 320 feet \times 90 feet.

One may say that this is truly a Coronation Show, and indeed there is so much to see. But amongst all the attractions it is hoped that every farmer will look in at the Ministry's exhibit (Stand No. 570 in Avenue K) where the theme of more meat from our own acres is being emphasized. The pig from birth to bacon, cross-breeding for better mutton, and the twelve-weeks rearing of table poultry are all being exhibited. Other features are: better hay by using the right seeds mixture, timely cutting and piking or tripoding; the building and shaping of apple trees on various systems; the saving of liquid manure, the making of farm roads, and keeping farm buildings in good repair; the mole-tile system of draining heavy land; facts about foot-and-mouth disease, and the importance of keeping sheep free from stomach worms.

For those who can spare the time, an excursion through the delightful countryside around Bath to see some of the Somerset farms "over the hedge" will be rewarding. The claim of the old ballad that names Somerset as "the flower of all the west countree" is still valid; and to it must now be added "a fine farming country."

Wise Stock Feeding: Despite the present public demand for the smaller table chicken throughout most of the year, the need for the family-size bird at Christmas still remains, and farmers who intend raising cockerels for this trade will soon be taking delivery of their chicks. In order to produce a carcass of good size and quality, every attention must be paid to correct feeding from day-old to maturity.

The food should be concentrated in form and easily digested. It must contain adequate amounts of carbohydrates, proteins, minerals and vitamins and a minimal amount of "roughage" necessary for healthy digestive function. Furthermore, it must be palatable and of a texture suited to the bird's particular requirements.

The feeding of dry mash in unrestricted quantity is a suitable system to adopt for the first 12 weeks, after which wet mash feeding may be introduced if desired, together with a small feed of grain. Home-grown cereals can comprise the greater part of the diet, and the use of a hammer mill is a decided advantage in grinding corn for poultry food. Oats should be finely ground and barley fairly fine, whereas wheat needs to be ground very coarsely on account of the glutenous nature of the flour and its tendency to paste in the bird's mouth. Wheat and barley may be used freely in poultry feeds, but oats should not exceed 20 per cent on account of their greater fibre content. Some wheat offals are desirable in the baby chick mash, and this may also

FARMING AFFAIRS

contain 20 per cent of maize meal, if obtainable, in place of a similar amount of wheat. Grain is not a complete food in itself and requires correct supplementation if the best results are to be obtained.

An important need of the Christmas chicken is protein, which must be provided in sufficient quantity to secure steady growth, good feathering and plenty of breast meat in time for the "finishing" period. This need is greatest during the early stages, and up to the age of eight weeks the chicks' diet should contain 18 per cent protein : thereafter this should be reduced gradually to 15 per cent and maintained at that level up to the beginning of the short period of fattening immediately prior to slaughter.

Cereals contain only about 10 per cent protein and their deficiency in this constituent is best rectified by the use of about 10 per cent of fishmeal or other good quality animal protein concentrates. This may be replaced in part by groundnut meal or soya bean meal, 5 parts of either being equal to 4 parts of fishmeal. Alternatively, 10 parts of beans or peas will also replace 4 parts of fishmeal. Some animal protein concentrates must always be included for best results, and 5 per cent should represent the minimum amount in a growers' ration. It is a mistake to overestimate the amount of protein which birds on range can obtain for themselves, particularly during dry summers.

Minerals are necessary for health and bone formation, and the inclusion of $1\frac{1}{2}$ per cent limestone flour and $\frac{1}{2}$ per cent common salt in a ration containing 7 per cent or more of fishmeal will be all that is normally necessary. Lack of sufficient manganese is a contributory factor in the condition called perosis, or slipped tendon, and although a deficiency in this element seldom occurs, the addition of a small amount of manganese sulphate to the ration is a worthwhile precaution. By carefully mixing $\frac{1}{4}$ lb. fine manganese sulphate with 10 lb. common salt, and using this treated salt at the $\frac{1}{2}$ per cent level previously mentioned, the bird's requirements will be met. Alternatively, farmers may prefer to use 2 per cent of a good proprietary poultry mineral mixture in place of the limestone flour and salt ; this is particularly convenient with a small number of birds.

The need for certain vitamins is greatest during the earlier stages of growth, and the baby chick mash needs supplementing with sources of vitamins A, D₃ and B₂ (riboflavin). Other essential vitamins will be present in the cereals and protein concentrates. One per cent of good quality cod liver oil, 5 per cent of high grade dried grass and 3 per cent of unextracted dried yeast (or 6 per cent dried milk) will provide these vitamins in adequate amounts ; or synthetic preparations of all three vitamins, obtainable in convenient dry form, will give equally satisfactory results.

After the eighth week the bird's need for riboflavin decreases and supplementation with this vitamin may cease. Growing stock out of doors during the summer will derive all their vitamin D₃ from the sun's action on their bodies, and as long as they have good grass or a supply of other green food at their disposal, they are not likely to be short of vitamin A. Cod liver oil and grassmeal (or their equivalents) should be restored to the ration from October onwards, and should be present at all times in the feed of birds raised in more confined conditions without access to natural sources of vitamins.

Although good quality birds can be raised under the extensive systems usually adopted on the general farm, it is of considerable advantage to restrict activity as far as possible during the 10-14 days prior to killing, in order to improve the quality and finish. This may be done by confinement in buildings, yards, folds or fattening coops. During this time the diet

FARMING AFFAIRS

should consist mainly of carbohydrates, with a bare minimum addition of protein foods, and fed to appetite as wet mash.

At all times an adequate supply of clean water is essential, and particular care must be taken to see that this is not overlooked during the hot weather.

Hard grit is required for development and proper function of the gizzard, and this, too, should be available at all times from soon after hatching : it should be of a grade appropriate to the bird's size.

The following mixture makes full use of home-grown materials and will be found suitable for the production of a good class Christmas chicken :

	Baby Chick Mash parts by weight	Growers' Mash parts by weight	Fatteners' Mash parts by weight
Middlings	20	—	—
Ground wheat	40	20	25
Ground barley	10	35	50
Ground oats	10	20	20
Ground beans or peas ..	—	10	—
Fishmeal	10	8	5
Dried grass	5	5	—
Unextracted dried yeast ..	3	—	—
Minerals	2	2	—
Cod liver oil equivalent ..	1	1	—

Dried grass and cod liver oil (or its equivalent) may be excluded from rations for growers on range in summer.

A change-over from baby chick mash to growers' mash should take place gradually from the eighth week, being completed two or three weeks later. A small grain feed may be introduced at 14 weeks, but this should not exceed one-quarter of the total food eaten otherwise growth rates will be retarded. More liberal grain feeding would require supplementing with a higher protein mash.

Where birds are put out on stubbles, grain consumption will of course be higher, and compensation for this must be made by the addition of a further 4 per cent of fishmeal, or 2 per cent of fishmeal and 5 per cent of beans or peas, to the growers' mash, which should then be fed at the rate of 2 oz. per head per day.

C. J. L. Baker

Farming Cameo :

31. Vale of Taunton Deane My particular district in Somerset lies in the south-west of the county and embraces the Blackdown Hills, the Vale of Taunton Deane, the foothills of the Brendons and the Quantocks, part of the low-lying Sedgmoor area around Athelney, and the heavy clay lands towards Ilminster. It embraces approximately 115,500 acres and there are 2,150 holdings. The gem of the district, however, is the Vale of Taunton Deane, famed in history and song, and from Wellington Monument on the Blackdown Hills which bound the Vale on the south, looking across the Vale to the Brendon Hills in the west and to the north to the Quantock Hills—where the wild Red Deer are still found—one of the richest and most productive mixed farming areas can be seen.

The Vale takes in approximately 30,000 acres, and its rich red soils have long been noted for their high fertility. During the reign of Elizabeth I, Camden, in 1586, recorded: "Country here is most delectable, on every side with green meadows, flourishing with pleasant gardens and orchards and replenished with fair manor houses and wonderfully contenteth the eye of

FARMING AFFAIRS

the beholder," while Collinson, in 1791, noted that "The lands are rich and fertile and all the environs of Taunton seem profusely furnished with the munificence of nature." Today the picture has not altered, and the Vale still retains its proud place in the forefront of British farming.

The soils found in the Vale are mixed in both type and texture, but the main types are derived from the Old Red Sandstone and Keuper Marls, although alongside the River Tone they are influenced considerably by alluvial deposits.

The area is predominantly and traditionally one of mixed farming, and in the past considerable numbers of cattle were fattened in yards and sheep were hurdled on the root crops in winter. Nowadays, dairy cows, mainly Shorthorns or Friesians, have to a large extent displaced the North Devons—the Red Rubies—and it is only on the larger farms that winter and summer fattening of cattle with the traditional flock of Down sheep is found. The winter hurdled flock is now rare and has not been replaced by a grass flock, although on many of the dairy farms a place could be found for a limited number of the former.

The land is well suited to arable cropping, and good yields of wheat, barley, oats and sugar beet are obtained. Potatoes, however, are not grown on a large scale. The most important cash crop is malting barley, and every year high yields of excellent malting barley are obtained on many farms. The climate is often tricky at harvest times and the introduction of the combine harvester has led to a great increase in the number of grain driers in the Vale. These are mainly of the sack drier and ventilated bin types, and in the difficult harvests of 1950 and 1951 they proved their worth many times over.

With a rainfall of fully thirty inches a year, conditions are suitable for the production of grass, and leys are widely used. On some farms, however, there is still an undue proportion of permanent grass which requires attention.

The orchards of the Vale have long been well known and, in the past, cider was made on every farm, wages being paid in part as cider. These days are gone; few farms now make cider and a number of cider orchards are being grubbed up and ploughed with the aid of the £10 per acre grant.

A. Adamson,
District Advisory Officer

BOOK REVIEWS

The Royal Gardeners. W. E. SHEWELL-COOPER. Cassell. 6s.

The English, as a people, have a natural love of gardens, and they will, therefore, the more readily place themselves in the sure and competent hands of Mr. Shewell-Cooper in a conducted tour of the Royal gardens at Buckingham Palace, Windsor, Sandringham, and Balmoral. King George VI and his Queen, despite the heavy claims of public duty which are the concomitant of the Crown, yet found the time to facilitate the author's quest to capture some of the beauty of the Royal gardens for the delectation of their subjects. And it can be said at once that Mr. Shewell-Cooper, so ably assisted by his wife (as the many photographs that adorn this book testify), has wasted not a moment of the opportunity so graciously accorded.

King George VI had a marked preference for informality and a discerning flair for the landscape possibilities that would set off a garden to its best advantage. He saw it whole, not in part, as evidenced by the many improvements at all four of the Royal homes which the author describes enthusiastically. He emphasizes equally the Queen Mother's love

BOOK REVIEWS

for masses of flowers, rioting in colour in well-sited borders—a love that goes hand in hand with the knowledge of how to attain the most effective and natural display.

There is a wealth of intimate detail which could be drawn from this book to titillate the appetite of the reader. But let one example suffice—the Bonnie Prince Charlie rose which is planted close to the front entrance at Balmoral. This rose is probably a species of the Scottish rose (*Rosa spinosissima*) which is illustrated on p. 4 of the art inset in this issue. The Queen Mother was particularly anxious to point it out to the author, as a lineal descendant of the rose sent from the Young Pretender's villa near Rome to the Lady of Nethermuirlands, a great supporter of the Jacobite cause.

To the floral beauties of the gardens, we have also to add the more prosaic but excellent fruit and vegetables which they contribute to the Royal Households. From Windsor, in particular, a vanload of vegetables, fruit and flowers leaves every day for Buckingham Palace.

Through this book we are privileged to visualize the Royal family in their home setting ; the gardens in which the young Prince Charles and Princess Anne will play their games, as our Queen and Princess Margaret did before them ; the gardens in which Her Majesty and Prince Philip will walk on a summer evening before dinner, savouring this personal heritage which is also part of the nation's wealth.

S.R.O'H.

British Farming, 1939-49. E. H. WHETHAM. Nelson. 12s. 6d.

In this short book Edith Whetham contrives to review in some detail the agricultural revolution of the 'forties. Like most revolutions, it is seen in retrospect, indeed it proved to all who lived through it, to be a tangled affair of imperfect forecasting and make-shift tactics while a stabler strategy was evolving. The tale is told as from an eyrie in Whitehall—though Miss Whetham disclaims sources of knowledge other than those open to the public—with periodical visits into the country to follow the fortunes of the "War Ags" and their successors. The decade is broken down into phases in each of which the national situation is summarized, the plan of campaign described, the results evaluated.

Today it requires some little effort of memory to recall that there was an early phase when planning of decreases gave quite as much concern as present-day planning for increases, and that before full control came the forces of economics gave to our price structure a bias in favour of barley from which it has even now scarcely recovered. We are reminded that for a long period specialist producers had a moral claim for compensatory prices because they could no longer produce the goods they had been accustomed to produce ; equity required that they should be "paid for not producing hogs".

Recital of the actual events of the war years evokes clearer memories : in these pages we can live again those strenuous days. At the time the performance of the planners and of the producers seemed wonderful ; it still seems so when the record is set out in cold print. Many areas of the country had neither the tools nor the skill to begin with ; it is small wonder that some of the corn stacks let in the rain. And as experience grew, the shortages developed ; there were never enough men, machines or spare parts. Phosphate and potash ran short just at the time we needed them most. For as the ploughs bit deeper, the less attractive lands had to be invaded, derelict farms had to be tackled ; the "War Ags" had to sally forth to the bogs and the mountain tops ; and there came a phase when their main preoccupation seemed to be searching for non-existent cooks to serve in their hostels. Yet somehow the plan and the performance tallied pretty well.

The record of the immediate post-war years is less flattering to our national self-esteem, for the forecasts of world conditions were sadly erroneous. "Reconstruction and famine" is no bad title to the chapter on this phase. Exact calculations had been made in 1940 of the minimum diet on which an Englishman could subsist, but in 1946 we had to learn to live on even less. The drastic measures taken in 1947 to step up production, however, bore their fruit in due season.

But it is to the chapters on finance that readers will turn with the greatest interest. From the premise that food output directly reflected the prices offered, Miss Whetham examines critically the responses of farmers, evaluates the effect on their finances and then endeavours to assess the merits of the bargain from the nation's standpoint. Obviously the proportionate returns would be likely to diminish as time went on and more money was invested in marginal lands and marginal men ; but were the returns reasonably satisfactory ? Could the increased output of those years, still more the great expansion between 1947 and 1952, have been obtained with equity to the farmers at lower cost to the State ? These are not simple questions to be answered yea or nay. The arguments for and against are set

BOOK REVIEWS

forth in an admirably judicial manner, and the reader is left to judge for himself. It is indeed open to him to judge whether in war-time reasoning on the lines of the Manchester school is strictly permissible. Hitler's armies and a proud defiant voice on the ether had something to do with the matter.

All students of agricultural affairs stand in debt to Miss Whetham for a book that is a model of clarity and learning.

W.B.M.

A Record of Agricultural Policy, 1947-52. E. H. WHETHAM. School of Agriculture, Cambridge University. 2s.

Miss Whetham adds an epilogue to her *British Farming* in the form of an Occasional Paper issued by the School of Agriculture, Cambridge. It covers roughly the period of the agricultural expansion programme. To preserve perspective, the economic problems of Britain through these troubled years are first reviewed, the dismal tale of hopes deferred, revived and dashed again, are recited. Measures taken to harness the agricultural industry and to spur it on are then detailed. The history of the various price reviews, with their shifting emphasis to meet changing situations, follows, and statistics of production are recorded as some measure of the cause/effect ratio.

It is a valuable compilation, alike as a work of reference and as food for thought in a period which clamours for long-term stability: for its tables of prices and production remind us that it takes two to complete a bargain, while its text reminds us that the economics of farming are but one facet of the nation's fortunes.

W.B.M.

The Sea Coast. J. A. STEERS. Collins. 25s.

"No island, no country is so rich in contrasts. The British coasts have everything...": so runs part of the publisher's note on the colossal task undertaken by J. A. Steers in *The Sea Coast*. As a recognized authority on our coastline, and as a professor of geography at Cambridge who reported on a survey of the coastline to the Minister of Town and Country Planning, we can expect a deep and learned work from this author.

The Sea Coast is not a book to read through. In places, it requires reference back over the pages, sometimes it reads easily with narrative, and in other instances the book is merely for reference when visiting the area. Many parts of the book are profoundly treated in the realms of geology, ecology and geography, and require of the reader something more than an elementary knowledge.

The description of the formation of shingle beaches and of sand dunes, the ecology of marsh saltings and the accounts of glacial weathering, water and wind erosion are very interesting; particularly so where the description relates to a part of the coastline with which the reader is familiar.

This is an authoritative work, and as a layman interested in the subject, I will venture only one criticism. Where the build-up of sand dunes is concerned with history, such as the burying of the oratory at Perranzabuloe, and where the soil of the Fens is related to the growth of woodland and fresh water meres traceable to the era of the early Bronze Age, I found that I was held in interest on all sides. I should, therefore, like to have encountered these departures from the geographical tour more frequently through the text.

Living on the east coast within sight of erosion, I was relieved to read that erosion and accretion are holding a balance around our coasts. The book is admirably illustrated with both coloured and black and white photographs and a number of good line-drawings.

P.J.O.T.

Exmoor. (The Regional Books Series). LAURENCE MEYNELL. Robert Hale. 18s.

The author has a deep affection for Exmoor and a special interest in its history, expressed in terms of its people and their doings. He has evidently taken great trouble to find out as much as possible, and it is all there for us to read. As the publishers rightly claim, the work is something of a history, geography lesson, guide book and gazetteer. The arrangement is not precise and the book is not easy to read, nevertheless it has an appeal and should attract many readers to this lovely stretch of country. Those who know the Exmoor Forest, northern Brendon Hills and the coastal strip will find the book covers all three. The author extends the area defined by his title to include the charming village of Stogumber; and who will disagree—except perhaps the Quantock people?

The writer on Exmoor has a great advantage—a long list of delightful place names. It is easy to say all Exmoor place names are remarkable, but it is never wise to be as dogmatic as the author when he says "we don't have yeomen in England now"; that is a bold statement to make in Jan Ridd's country! A few simple things mean Exmoor to those who

BOOK REVIEWS

know it; the surprising depth of the coombes—the author visited Lyncombe, and does it not hide at the bottom of as steep a coombe as any on the Moor? The now common buzzard perches on a roadside gatepost or hangs in the sky; he is the badge of Exmoor. These are only two examples; what pleasure it is to recall others!

History, it has been said, includes the present, and we should hear more of the district as it is today. The people are primarily an agricultural community and the very real benefits flowing from schemes under the Hill Farming and Livestock Rearing Acts deserve mention in any history of the district and its people; the good these measures have done is there to be seen—the new buildings, the new cottages, the hard roads, the piped water supply. The National Trust also deserves more prominence in any book about a district where none has laboured more than they to such purpose in preserving unspoilt prosperity. Who knows, too, the extent of the good done to Exmoor by Sir Robert Waley Cohen—a modern land improver by precept and example, who introduced modern methods with their promise of greater reward for greater effort. We read of Honeymead but not about its late owner who loved Exmoor as well as any man.

Even with its limitations, this is a book to be commended to the country-lover, and its appeal will assuredly extend far beyond the confines of its subject-matter.

R.G.A.L.

Mountain Birds. R. A. H. COOMBES. Illustrated by G. E. Lodge. King Penguin Books. 4s. 6d.

This small book describes separately the appearance, habits, food and distribution of sixteen species of birds which occur in mountain areas of Britain. Probably its main attraction lies in the series of accurate and beautiful coloured plates of each bird from paintings by G. E. Lodge, which have been remarkably well presented for a book at this price.

A new and useful feature, which will appeal to many bird-watchers, is the inclusion of the French, German, Dutch, Danish and Swedish names for each bird. It is a great pity, however, that the Gaelic and Welsh names, where they exist, are not given as well, since these birds often live in areas where our other two British languages are spoken.

There is little of practical interest in this book for the farmer, chiefly because the mountain zone, as distinct from moorlands and uplands, cannot by its very nature, be exploited much by men, nor indeed by many forms of wild life. Mr. Coombes states his opinions as a naturalist on the good or harm done by several of the birds mentioned and comes to the conclusion that only the carrion-crow does appreciable harm.

It is surprising that of the birds which have a wide range of habitat, including the mountain zone, some like the kestrel are included while others like the wren and wheatear are not.

M.G.R.

British Flower Industry Association. Coronation Souvenir Journal.

"At all times of great emotion, whether it be national or something very personal, flowers always come to our rescue. They can help to demonstrate our affection, to soften tragedy and anxiety, and to provide a beautiful background to a happy and joyful event." So says David Longman in his article in the B.F.I.A.'s *Coronation Souvenir Journal*. There is no doubt that during this month, in festivities and celebrations throughout the country, flowers will make their fitting contribution.

It is a popular topical theme to seek comparison with the age of the first Elizabeth, and several of the thirty odd articles in this book are, indeed, in this vein. But in looking back, the writers are also in effect, recording the history of the industry itself. For in those far-off days of the sixteenth century, when sweet-scented rosemary, lavender, thyme and mignonette were peddled in the street, production was confined to a few private gardens, and although the florist gradually took his place in society in the ensuing years, it was not until the Victorian era of potted palms and aspidistras that the foundations of the highly developed flower industry we know today were established. This souvenir is, however, much more than a history; it contains a wealth of interesting and instructive information, contributed by specialists whose names are known to us all, on subjects varying from the cultivation of particular flowers for cutting—the rose, chrysanthemum, orchid and carnation, to name but a few—to the arts of floral decoration and the cultural, educational and scientific matters pertaining to the industry. It has a number of illustrations (some in colour), and even the coloured advertisements have a dignity and beauty of their own.

In short, this is a delightful miscellany of reminiscence, history and specialized knowledge which seems destined to be treasured by flower-lovers long after the notable event which has called it into being.

Copies of the book are available to non-members, price 2s. 10d. (including postage) from the Secretary of the Association, 35 Wellington Street, Covent Garden, W.C.2.

L.W.T.

*Copyright attributions of photographs
used in the art supplement*

Page

- i Sport and General.
- ii (left to right) P.A.-Reuter Photos ; Sport and General ; R.A.S.E. ; Western Morning News ; Shrewsbury Chronicle ; Sport and General ; Farmer and Stock-Breeder.
- iii Central Press Photos.
- iv-v Reginald A. Malby.
- vi Farmer and Stock-Breeder ; Sport and General ; Sport and General.
- vii Farmer and Stock-Breeder ; Sport and General ; Farmer and Stock-Breeder.
- viii Horticultural Photo Supply Service ; Horticultural Photo Supply Service ; Crown ; Crown.

● NEXT MONTH ●

The July issue of *AGRICULTURE*, the month of
Royal Show at Blackpool, will focus the spotlight
on

Lancashire Farming

The only way to make *sure* of your copy is by a
subscription placed with your newsagent, book-
seller or direct with H.M. Stationery Office.

“ AGRICULTURE ”

Price 9d. net monthly, post free. (Foreign countries, 11d. post free).

Subscription Rates (including postage) :

Inland and Imperial	9s. per annum
Foreign Countries	11s. per annum

*Subscription may start with any issue
and should be sent to*

H.M. STATIONERY OFFICE

York House, Kingsway, LONDON, W.C.2	423 Oxford Street, LONDON, W.1
P.O. Box 569, LONDON, S.E.1	
13a Castle Street, EDINBURGH, 2	1 St. Andrew's Crescent, CARDIFF
39 King Street, MANCHESTER, 2	1 Tower Lane, BRISTOL, 1
2 Edmund Street, BIRMINGHAM, 3	80 Chichester Street, BELFAST

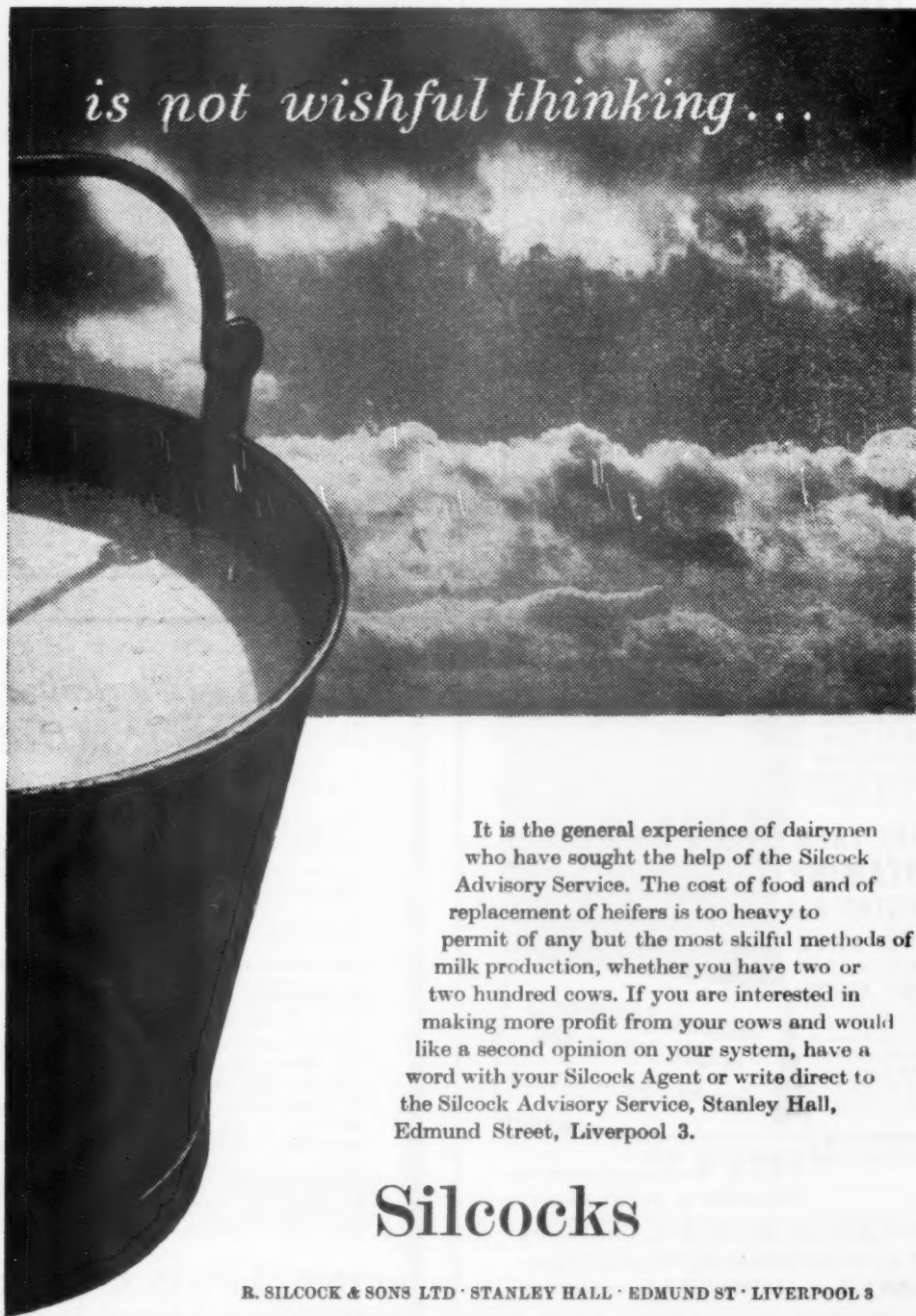
Single copies can be purchased from any of the above-mentioned addresses
or through a bookseller

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by Staples Printers Limited at their Kettering, Northants, establishment.

(415) Ps.27 20D/40 K/102 5/63 SP/TBH G.521

More milk at lower cost

is not wishful thinking...



It is the general experience of dairymen who have sought the help of the Silcock Advisory Service. The cost of food and of replacement of heifers is too heavy to permit of any but the most skilful methods of milk production, whether you have two or two hundred cows. If you are interested in making more profit from your cows and would like a second opinion on your system, have a word with your Silcock Agent or write direct to the Silcock Advisory Service, Stanley Hall, Edmund Street, Liverpool 3.

Silcocks

R. SILCOCK & SONS LTD · STANLEY HALL · EDMUND ST · LIVERPOOL 3

Please mention AGRICULTURE when corresponding with Advertisers

BERNARD THORPE & PARTNERS

LAND AGENTS, SURVEYORS,
VALUERS and AUCTIONEERS

Forestry Surveyors, Timber
Valuations and Sales

AGRICULTURAL ESTATE MANAGEMENT

in all parts of the British Isles

Head Office:

32 MILLBANK, WESTMINSTER
LONDON, S.W.1 Tel. VICToria 3012

Branch Offices:

129 Mount Street, London, W.1
Tel. GROsvenor 2501

Kenley House, Oxted, Surrey
Tel. Oxted 975

21a Ainslie Place, Edinburgh
Tel. Edinburgh 34351
and at Newcastle

The reward to come?

For the birds, wheeling and swooping behind the plough, the furrows provide a rich harvest. What reward will they bring to the farmer? The question is one which affects us all. That is why, in good times and in bad, the Westminster Bank stands squarely behind its farming customers. Its ready and practical assistance can reduce the impact of a bad season; its efficient but friendly service is an asset in times of prosperity.

It is, therefore, sound commonsense
to have an account with the
Westminster Bank

WESTMINSTER BANK LIMITED

FOR RAPID
HEALTHY
GROWTH IN
POULTRY &
LIVESTOCK

GIVE THEM
VITAMINS
THIS EASY WAY

AND SAVE
£££'s IN
FEED COSTS

Just weigh out
the quantity re-
quired and mix
with the feed
— quickly
and easily.

VITAMINS & ANTIBIOTICS
IN ONE SINGLE BAG
(as soon as officially sanctioned)

BETA D.3 (Regd. Trademark)
VITAMIN D SUPPLEMENT

PLUS ANY OR ALL OF THE FOLLOWING

VIT. A, VIT. B.2 (Riboflavin), VIT. B.12, PANTOTHENIC ACID, plus ANTIBIOTICS (when authorised)

Write for free leaflet giving full details of Beta Vitamin Supplements to: Dept. D, **V. W. EVES & CO. LTD.**
9-10 Railway Approach, London Bridge, S.E.1. Phone: HOP 0940

Books on Agriculture, Botany and Allied Sciences

of all publishers
supplied from stock.

Catalogue of Books on Agriculture, Horticulture, available post free on request. Please state interests.

Scientific Lending Library

New Books and latest editions obtainable.

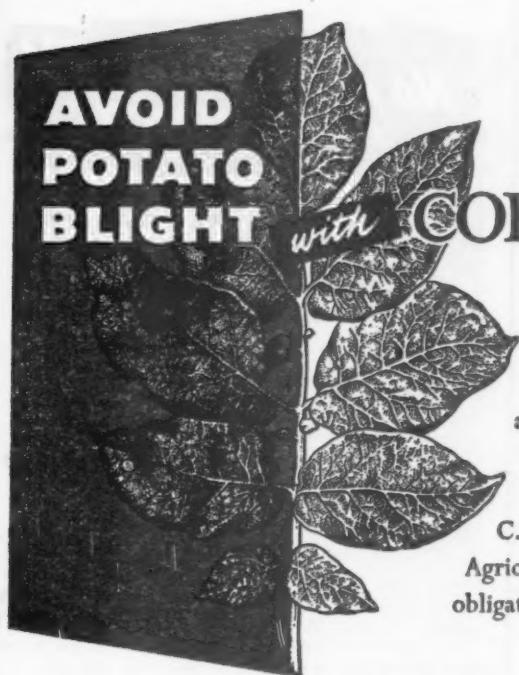
ANNUAL SUBSCRIPTION, TOWN OR COUNTRY,
FROM TWENTY-FIVE SHILLINGS

THE LIBRARY CATALOGUE revised to December 1949, containing a classified Index of Authors and Subjects.
To Subscribers 17s. 6d. net., to non-subscribers 35s. net., postage 1s. 3d.
Supplement 1950 to 1952 in preparation.

Second-Hand Books
140 GOWER STREET, W.C.1

H. K. LEWIS & Co. Ltd.
LONDON: 136 Gower St., W.C.1
Telephone: EUSton 4282 (7 lines)

Please mention AGRICULTURE when corresponding with Advertisers



**AVOID
POTATO
BLIGHT**

with **COPPER Compounds**

Every year thousands of tons of potatoes are lost through potato blight. This loss to the farmer and to the nation can be avoided by timely spraying with Copper Compounds. This subject, as well as many others, is discussed fully and authoritatively in the C.D.A. publication "Copper Compounds in Agriculture" which is available free of charge or obligation on request.

COPPER DEVELOPMENT ASSOCIATION
KENDALS HALL • RADLETT • HERTS • RADLETT 5616



Take Expert Advice!

"The addition of dredge corn to your cows' diet is likely to lower the protein content, which is undesirable for milk production. I suggest you grind the dredge corn for your pigs, but it would be a great help if you could include 1 cwt. fish meal with every 10 cwt. of dredge corn." J.M.

How many thousands of readers have been advised to "include fish meal" in the ration? The leading veterinary and feed experts must be completely satisfied that white fish meal contains the most important feed ingredients on the market, or they would not constantly recommend its inclusion.

They recognise that fish meal is a great reservoir of many feed factors, and that no effective substitute of equal quality can be advised. Profit by their knowledge and advice, they have the complete answer to feeding problems!

Demand is heavy—Be patient with your Merchant.



Write for free brochure to—

The Association of Fish Meal Manufacturers
Toddington Manor, Toddington, Beds.

SEED POTATOES

From the best stocks in Scotland,
Northern Ireland, England or Eire.

J. JOHNSON & SON, LTD.

(Established 1870)

GROWERS, EXPORTERS and MERCHANTS

Head Office:

Great Nelson Street, LIVERPOOL. 'Phone: North 2077/8/9

Branch Offices:

12 Leonard Street, PERTH, Scotland. Phone: Perth 3188

23 Kingsland Road, St. Phillips, BRISTOL 2. Phone: Bristol 57695

Water Street, LONDONDERRY, N.I. Phone: Londonderry 2738

The Square, KILKEEL, Co. Down, N.I. Phone: Killeel 331

Arleston, WELLINGTON, Salop. Phone: Wellington 289

Also HAVERFORDWEST and CAMBRIDGE

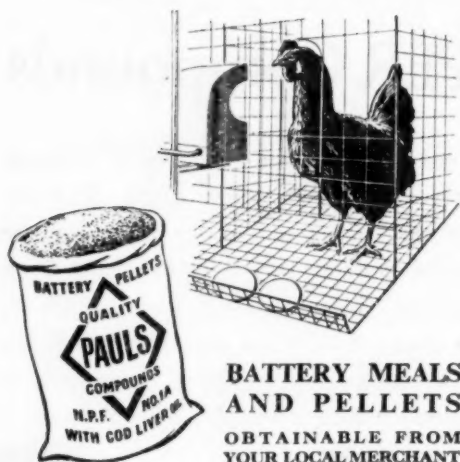
Experimental plots open for inspection on our own farm in Cheshire. All seeds packed under our celebrated "SUN BRAND" design.

SEED POTATOES are a matter of trust between buyer and seller, so place your orders with an old-established reliable House!

If you are interested in quantities of less than 6 cwt. and down to 14 lb. of any variety, please write our Associate Company—**S. & W. YOUNG LIMITED, SEED POTATO MERCHANTS, GT. NELSON STREET, LIVERPOOL 3**, who handle exclusively our seed Potatoes in small quantities.

Please mention **AGRICULTURE** when corresponding with Advertisers

POULTRY Prefer PAULS



**BATTERY MEALS
AND PELLETS**
OBTAINABLE FROM
YOUR LOCAL MERCHANT

Manufactured by

R. & W. PAUL LTD

MILLS AT : LONDON, IPSWICH, KING'S LYNN,
HULL, MANCHESTER, AVONMOUTH, FAYERSHAM.

No more MUDDY FARM YARDS



**LAY YOUR OWN
CONCRETE**
BY THE

CHEECOL

(Patent No 554863)



EASY WAY

You can use your own labour
at times when it can be spared
from other work, and you will
**SAVE 50% LABOUR,
50% TIME, 33% COST**
over normal methods of con-
creting.

★ Our technical services are
available to you. Write AT
ONCE for full particulars and
trial gallon 35/- delivered.

CHEECOL PROCESSES LTD.

Keeland House, 644 Oxford Road, Reading

Telephone: Reading 60821

1832

By Appointment
Seedsmen to



The Late
King George VI

1953

DUNNS

FARM SEEDS LTD.
Seed Specialists Salisbury
Britain's Premier Seedsmen

Scientific Adviser:
Sir R. GEORGE STAPLEDON,
C.B.E., D.Sc., F.R.S.

PLAN YOUR WINTER KEEP NOW

By sowing an acreage of various varieties
of brassicas food can be provided through-
out most of the winter and thus reduce
the amount of purchased concentrates
required. May we suggest a plan without
any obligation?

**THE BOOK OF DUNNS
FARM SEEDS 1953**

Post free on request—apply now

Telegrams:
Dunnseed Salisbury

Telephone:
Salisbury 3247-8-9



**Jack
BARCLAY**
LIMITED

The Largest Official Retailers of
ROLLS-ROYCE & BENTLEY
Stock List of Used Cars on request.



Berkley Square, London, W.1. Telephone: MAYfair 7444

Please mention AGRICULTURE when corresponding with Advertisers

BY APPOINTMENT AGRICULTURAL SPRAYING



CONTRACTORS TO THE LATE KING GEORGE VI.

Springclean your pasture with

Phenoxylenes 30

the hormone weedkiller
with extra selectivity



Prepare your grassland to support more stock than ever you thought it could. Spray with Phenoxylenes — the hormone weedkiller which selects the weeds for destruction and does no harm to established grasses and clovers. Phenoxylenes works so well because it includes not only M.C.P.A. but other carefully chosen substances which give added selectivity. Thousands of acres of pasture have been raised to high levels of productivity by Phenoxylenes. Why not yours?

For complete information write to:

PEST CONTROL LTD.

OF CAMBRIDGE Telephone: Harston 312



Regd. Trade Mk.

ROYAL AGRICULTURAL



SOCIETY OF ENGLAND

ROYAL SHOW

BLACKPOOL, JULY 7th — 10th

Open from 8 a.m. to 8 p.m. on July 7th — when the judging of livestock takes place, and from 9 a.m. to 8 p.m. on July 8th, 9th and 10th.

PRICES OF DAILY ADMISSION

There is no admission after 7 p.m. on any day.

TUESDAY July 7th - £1 WEDNESDAY July 8th (before 2 p.m.) - 10s. (after 2 p.m.) - 5s.
THURSDAY July 9th - 5s. FRIDAY July 10th - 2s. 6d. Children half-price. Season Tickets,
admitting on any or all of the four days - £1 10s.

REDUCED RATES for parties of ten or more adults are obtainable by application to the Society before the Show. Ten tickets will be issued for the price of eight, with a similar reduction of 20 per cent for any greater number.

Membership of the Society is available to anyone interested in agriculture. Details of Show and other privileges can be obtained from the Secretary, 16 Bedford Square, London, W.C.1.

21-W.50.

Please mention AGRICULTURE when corresponding with Advertisers

potato blight ★ and other fungus diseases

★ CONTROL and PREVENT
BY SPRAYING WITH
**BORDEAUX
MIXTURE**

The mixture should only be
made with the best quality

SULPHATE OF COPPER
Guaranteed 98/100%

SULPHATE OF COPPER
is also most effective in killing the mud snail which
carries the
LIVER FLUKE

**BRITISH SULPHATE OF COPPER
ASSOCIATION LTD.**

1 GT. CUMBERLAND PLACE, LONDON, W.1

* Grams:
"Britsulcop, Wesphone, London"

* Phone:
Paddington 3068/9

FIRE! WHICH COLOUR NU-SWIFT?

Red, blue or black? Distinctive colours
for different fire risks prevent costly
errors. Are your extinguishers the right
colours? Write, or phone Elland 2852,
for free advice.



NU-SWIFT LTD. • ELLAND • YORKS
In Every Ship of the Royal Navy

BLUE-CROSS

BALANCED RATIONS

(Containing Vitamealeo)

complete the
nourishment needs
of CATTLE · PIGS
and POULTRY

By Appointment
to Her Majesty the Queen
and the Royal Household
of the late King George VI

Manufactured by
JOSEPH RANK LTD and Associated Companies

FOOD
DRIVE

CRAVEN PRODUCTS

FOR SUMMER USE

"PETH 40" T.E.P.P. for controlling:
Aphis, Woolly Aphis, Red Spider,
Thrips, and White Fly on Apples, Pears,
Plums, Strawberries, Peaches, Brassica,
Lettuce, Beans, Peas, and Cucumbers.
Also Carnations, Cineraria, Roses and
Lilies.

"MYCOL" COLLOIDAL COPPER for
Treatment of Fungus Diseases which attack
Fruit Trees, Bushes, Ground Crops,
Flowers, etc.

"AQUILITE" Dispersible SULPHUR
for use against Apple and Pear Scab,
Mildew, Gooseberry, Mildew, etc.

For full particulars apply:

W. J. CRAVEN & CO. LTD.
EVESHAM

Remember! The proved formula
for success is good breeding,
good management, good feeding.

Pigs

pay well

on



*Wherever you live,
there's a Bibby District Manager near to you
... Bibby Feeds ... Twyford Pedigree Seed.*



J B I B B Y & S O N S L I M I T E D L I V E R P O O L 3

Please mention AGRICULTURE when corresponding with Advertisers



**Why
hump
5 cwt
when
2 cwt
will do
the
same
job?**

Fisons Triple

(containing 47% soluble P_2O_5)

Gross Price per ton	- - -	£36. 3. 4
Government Subsidy per ton		£12. 14. 6
COST TO YOU PER TON	- - -	£23. 8. 10

*These prices are for 6-ton lots,
carriage paid to your station.*

Fisons Triple

(containing 47% soluble P_2O_5)

Saves LABOUR

Two cwt. of Fisons Triple (containing 47% soluble P_2O_5) do the work of 5 cwt. of ordinary superphosphate. You have only two-fifths the weight to handle, load and spread. Labour saved is money saved.

Saves TIME

You can fill your fertilizer drill with Fisons Triple and it will cover two and a half times as much ground between fillings as it can if you use ordinary superphosphate. Each stop you *don't* make is time saved, money saved. And remember, Fisons Triple is also ideal for hand sowing.

Saves SPACE

You can store your season's supply of Fisons Triple in two-fifths the space that ordinary superphosphate would need. Fisons Triple stores well, flows freely and will not cake. It is the cheapest and most efficient soluble phosphatic fertilizer on the market.



It's Fisons for Fertilizers

From all leading Corn and Agricultural Merchants



Please mention AGRICULTURE when corresponding with Advertisers